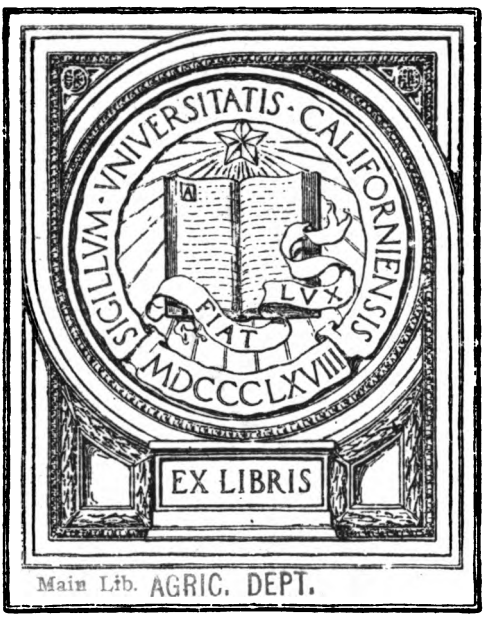


REPORT

OF THE

STATE FORESTER

OF WISCONSIN

For 1909 and 1910

MADISON, WIS.
DEMOCRAT PRINTING COMPANY, STATE PRINTER
1910

REPORT

OF THE

STATE FORESTER

OF WISCONSIN

For 1909 and 1910

MADISON, WIS.
DEMOCRAT PRINTING COMPANY, STATE PRINTER
1910

STATE BOARD OF FORESTRY

MEMBERS OF THE BOARD

CHARLES RICHARD VAN HISE, CHAIRMAN,
President University of Wisconsin.

H. L. RUSSELL,
Dean State Agricultural College.

EDWARD ASAHEL BIRGE,
Director State Geological Survey.

FRANK L. GILBERT,
Attorney General.

GEORGE BEYER,
Oconto.

EDWARD MERRIAM GRIFFITH,
State Forester.

FRANK B. MOODY,
Assistant State Forester.

M. A. CASTLE,
Clerk.

CONTENTS.

OFFICE OF THE STATE FORESTER,

MADISON, WIS., Dec. 31, 1910.

State Board of Forestry.

GENTLEMEN: I have the honor to submit herewith my report for 1909 and 1910.

Very respectfully,

E. M. GRIFFITH,

State Forester.

Report of the State Forester

INTRODUCTION.

It is now over seven years since the passage of the first forestry law in 1903, so that the recommendations in this report are based upon experience. The state forest reserves have grown in these years from 40,000 acres to 340,000 acres, but the state must have a reserve of at least 2,000,000 acres in order to protect the headwaters of our most important rivers; to aid in retaining our wood-using industries within the state by supplying them with timber, their raw material which they must have, and to protect the beauty of our wonderful northern lake region that should annually bring millions of dollars into the state, through tourists, campers, hunters and fishermen.

Our loss of forest resources by forest fires has been simply appalling amounting to $9,000,000 in 1908, and to over $5,000,000 in 1910, and our town fire warden system has proved absolutely inadequate, as it is based upon the wrong principle of fighting fires after they occur and not of preventing them.

All who have studied the question agree that the time has come when the legislature must look at the forestry work from the broad view point of the best state policy and decide definitely what the future policy shall be.

Wisconsin has ranked as one of the greatest lumber producing states in the Union and much of her wealth has and should come from her forests. However, the figures compiled by the U. S. Census Bureau show us how rapidly Wisconsin is losing her proud position in lumber production, for while she ranked first in 1900 the figures for 1910 show that she has dropped to eighth place and that the decrease in production has been 40%, which is a greater loss than that of any other state.

Our wood-using industries consume annually more than 930 million board feet of lumber valued at $20,000,000, and this

is only a part of the lumber industry of the state, as the figures given do not include the output of the sawmills or other forest products that are not considered as raw material for further manufacture. Even at the present time only 50% of the lumber that is used by our wood-using industries is grown in Wisconsin.

The wonderful forest resources of the state have been fearfully depleted by forest fires and in order to save the remaining forests and retain the wood-using industries within the state, the enormous annual losses from fires must be stopped. It is worse than useless to temporize or try to cheat ourselves into thinking that some of the old makeshifts will do.

The State Conservation commission, the Special Legislative committee on Waterpowers, Forestry and Drainage, and the State Board of Forestry, after careful study of the whole situation, all join in recommending to the legislature that a general state tax of 2–10 of a mill be levied and collected annually for twenty years and that the proceeds be granted to the State Board of Forestry in order to purchase the lands that it is absolutely necessary for the state to own in order to consolidate the forest reserves and thus make forestry management possible; to pay for the protection and improvement of the forest reserves and also for a forest fire patrol system that will be organized to prevent, as far as possible, the starting of forest fires in all the forest regions of Wisconsin. Such a tax will yield about $600,000 a year and it is estimated that in ordinary seasons of average fire danger, the patrol system will cost $250,000, leaving $350,000 a year for the purchase of state forest reserve lands and their improvement and protection.

To many members of our legislature this will seem a very large sum to devote to the work but such a revenue is absolutely necessary if our forest lands are to be saved from destruction by fire and if the state is to acquire an adequate forest reserve. The patrol system will be called upon to protect some 13,000,000 acres of land and the amount asked for this work, $250,000, means therefore an expenditure of only 2 cents per acre annually which is the very lowest amount for which any reasonably adequate patrol can be secured.

As explained, the state should acquire a forest reserve of 2,000,000 acres, while the reserves now comprise 340,000 acres, leaving 1,660,000 acres to be purchased. These lands can probably be secured at an average cost of $4 per acre and upon this

basis $6,640,000 must be expended in twenty years, leaving some $400,000 for the protection and improvement of the reserves.

It will be seen from the above that at least $600,000 will be required annually and that a 2-10 of a mill tax will yield this amount. As State Forester, I have attempted in the following report to make plain the great necessity of taking prompt action in this matter and the absolute need of spending a large amount of money to protect and conserve our forest resources.

This question is not presented for the first time but has been before the people for the past two years, and it is believed that they fully appreciate the need and would readily pay the tax that is asked. The matter is now clearly before the legislature and it is hoped that they will see the great importance of prompt action and will carry out the recommendations of the Special Legislative committee, which has studied this matter for two years, by providing that the State Board of Forestry shall have the proceeds of a 2-10 of a mill tax for a period of twenty years. Mere talk or good intentions will not conserve our forest resources, and the great importance of deciding upon a clear, definite forest policy demands the best efforts of our legislature.

GROWING PUBLIC SENTIMENT FOR FORESTRY.

The great importance of the forestry movement has been emphasized repeatedly of late years in the utterances of prominent men, in the official messages of our governors and presidents, in resolutions and declarations formulated by conventions and congresses, in political platforms and in trade journals and many periodicals of more general interest. It would be impossible to reproduce here any large number of such statements advocating forestry, but a few have been selected to show the great growth of public sentiment for forestry, both in the state and in the nation.

Theodore Roosevelt. Special Message to Congress, Jan. 22, 1909.

We know now that our forests are fast disappearing, that less than one-fifth of them are being conserved, and that no good purpose can be met by failing to provide the relatively small sums needed for the protection, use and improvement of all forests still owned by the Government, and to enact laws to check the wasteful destruction of the forests in private hands. There are differences of opinion as to many public questions; but the American people stand nearly as a unit for waterway development and for forest protection.

Message of President William H. Taft to Congress, Dec. 5. 1910

Nothing can be more important in the matter of conservation than the treatment of our forest lands. It was probably the ruthless destruction of forests in the older states that first called attention to the necessity for a halt in the waste of our resources.

Governor Robert M. LaFollette of Wisconsin. Special Message of April 12, 1905.

. . . . The state forestry legislation, adopted two years ago, very defective in many respects, will it is hoped be so amended as to establish this important work upon a permanent and efficient basis. It is referred to in this connection because the pre-

servation of our forests and the reforesting of lands about the sources and along the head waters of our principal streams, are absolutely essential to the preservation of Wisconsin's splendid waterpowers. The restoration of our forests, and the preservation of our waterpowers go hand in hand.

Governor Charles E. Hughes of New York. Message of January 1, 1908.

It would be difficult to name any matter of greater importance to the people than the conservation of our forests. To this end the State should largely extend its purchases and so far as possible avoid the increased cost which will be entailed by delay. Any effort on behalf of private interests to invade the common right in these lands and their maintenance for the public benefit should be defeated.

Governor James O. Davidson of Wisconsin. Message of January 13, 1909.

For many years thoughtful men throughout this nation have been sounding a warning against the wholesale destruction of our forest areas. . . . Our forest reserve now comprises 300,000 acres of land . . . The acquiring of other lands for forestry purposes, especially on or near the headwaters of our streams, should be encouraged.

Declaration of Governors at the Conference of Governors in the White House, Washington, D. C., May 13—15, 1908.

We agree . . . that the forests which regulate our rivers, support our industries, and promote the fertility and productiveness of the soil should be preserved and perpetuated . . .

We urge the continuation and extension of forest policies adapted to secure the husbanding and renewal of our diminishing timber supply, the prevention of soil erosion, the protection of headwaters, and the maintenance of the purity and navigability of our streams. We recognize that the private ownership of forest lands entails responsibilities in the interests of all the People, and we favor the enactment of laws looking to the protection and replacement of privately owned forests.

Report of the National Conservation Commission, Dec. 7, 1908.

The conservative use of the forest and of timber by American

citizens will not be general until they learn how to practice forestry. Through a vigorous national campaign in education, forestry has taken root in the great body of American citizenship. The basis already exists upon which to build a structure of forest conservation which will endure. This needs the definite commitment of state governments and the Federal Government to their inherent duty of teaching the people how to care for their forests . . .

Under right management, our forests will yield over four times as much as now. We can reduce waste in the woods and in the mill at least one-third, with present as well as future profit. We can perpetuate the naval stores industry. Preservative treatment will reduce by one-fifth the quantly of timber used in the water or in the ground. We can practically stop forest fires at a cost yearly of one-fifth the value of the merchantable timber burned.

Declaration of Principles Adopted by the North American Conservation Congress, held at Washington, D. C., Feb. 23, 1909.

We recognize the forests as indispensable to civilization and public welfare. They furnish material for construction and manufacture and promote the habitability of the earth. We regard the wise use, effective protection, especially from fire, and prompt renewal of the forests on land best adapted to such use as a public necessity and hence a public duty devolving upon all forest owners alike, whether public, corporate or individual.

We consider the creation of many and large forest reservations and their permanent maintenance under government control absolutely essential to the public welfare.

Summary of recommendations contained in the Report of Senators Paul O. Husting and Henry Krumrey, Members of Special Legislative Committee appointed to investigate and recommend Legislation relating to water powers, forestry and drainage, January 24, 1910.

1. The passage of bill No. 502, S., so amended as to provide a state tax of two-tenths of one mill for each dollar of the assessed valuation of the taxable property in the state, to be collected annually for a period of twenty years, the tax when levied and collected to constitute "a forestry investment fund" to be used

for the purchase, improvement and protection of forest reserve lands.

2. The passage of amendment No. 2, to bill 468, S., which provides for the piling and burning of white, Norway and jack pine slash in Wisconsin.

3. To the careful consideration of the lumbermen of the state of Wisconsin the utilization of hardwood slash by means of chemical plants.

4. The employment of an effcient fire patrol by the state board of forestry.

Report of the Committee on Forestry of the National Hardwood Lumber association at the 13th annual convention held in Louisville, Kentucky, June 9—10, 1910.

Among the nations of the world the United States has for the past fifty years been noted as a country of deplorable waste, and, as we know, the hardwood lumber industry has keenly felt this lack of economy. We believe that our association has had much to do with the present recognition on the part of the chief executive of our nation and of Congress, as to the crying need for the enforcement of such regulations as will effectively bring about a real conservation of the natural and national resources of this country . . . .

At the present rate of consumption in the United States of over 50 billion feet of lumber per annum, it requires no prophet to foresee a complete exhaustion of the visible supply, unless a superhuman effort is exerted by the national and state legislatures, together with co-operation on the part of all men interested in lumber, to safeguard the standing timber and adopt effective measures for reforestation.

Platform of the second National Conservation congress held at St. Paul, Minnesota, September 5—9, 1910.

We earnestly recommend that the states and federal government acquire for reforestation lands not more valuable for other purposes, and that all existing forests publicly and privately owned be fully protected by state and federal governments. We recognize the invaluable services of the forest service to the people and earnestly recommend that it be more generously supported by the federal government, and that state, federal and private fire patrol be more generously provided for the preserva-

tion of forests and human life; and appreciate and approve of the continuance of the service of the United States army in fire patrol in emergencies.

From the statement of principles and policies of the Southern Conservation congress held at Atlanta, Georgia, October 8, 1910.

We hold firmly and unalterably, that such conservation of our natural resources as is consisitent with their proper and wise utilization is a deep moral obligation, and that only through recognition and observance of this obligation can the perpetuity of our people be assured . . . .

Approving the federal forest policy and indorsing the service whereby this policy is carried out, we urge upon our states the establishment of state forests and the enactment of laws insuring the conservation of forests in private possession; such laws to provide for more equitable taxation, prevention of forest fires and reforestation of lands less valuable for other purposes.

Recommendations of the Northern Hemlock and Hardwood Manufacturers' Association.

The Forest Fire Committee of the Association met with State Forester E. M. Griffith, and Assistant State Forester, F. B. Moody at Milwaukee on Nov. 12, 1910 to discuss plans for the prevention and control of forest fires in Wisconsin. After consideration of the tentative measures proposed by the State Board of Forestry, the Committee decided to recommend the following propositions:

First, that a two-tenths of a mill state tax be levied to provide a fund for fire prevention and the purchase and protection of state forest reserve land.

Second, That the State Board of Forestry expend such portion of this fund as may be necessary for patrols in the forest counties on the basis of not less than one patrol to each 40,000 acres of total area.

Third, that efficient county fire wardens be substituted for the present town fire wardens.

Fourth, that there be strict regulation of the burning of brush and debris to clear land during the dry season under the direction of patrolmen.

Fifth, that the State Board of Forestry should have the right

to order the disposal of slash adjacent to standing timber or other valuable property in such manner as to provide a reasonably safe fire line.

Resolutions of the Lake States Forest Fire Conference.

The Lake States Forest Fire Conference was held in St. Paul December 6 and 7, under the auspices of the Minnesota State Forestry Board and the Minnesota Forestry Association. It was composed of strong representatives of the lumbermen, timber owners, railroads, state boards, United States Government and others who are vitally interested in the prevention of forest fires in Minnesota, Wisconsin and Michigan.

After thorough discussion of all phases of the question, the following resolutions were unanimously adopted:

Resolved, That we recommend to the legislatures of our States:

First. That the forest fire protection of each State and such other branches of state work as may be deemed best to combine with it, be placed under the control of a non-partisan Commission empowered, as fully as possible under the Constitutions of the different States, to carry on the work, and under civil service rules. Such Commission should represent all the interests involved as far as possible, and we recommend that such Commission place the work in charge of a Chief Forester who should be a professional graduate Forester and that the Commission employ such trained Foresters and other assistants as may be necessary; define their duties and fix their salaries; said employes to be engaged under such civil service regulations as the Commission may prescribe.

Second, Resolved, That it is the sense of this Conference that the present Forest Fire Warden Service of Michigan, Wisconsin and Minnesota, is totally inadequate to meet the existing fire hazard to both life and property, and that forest protection service, to become efficient, must be greatly extended. To this end we recommend an adequate Forest Patrol System, maintained by the State, organized and operated by the Commission referred to.

Third. We further recommend, that the Commission be authorized to co-operate with the National Government, the several adjoining States, and such associations and organizations as the Commission may find necessary to best protect the timber resources of the State.

Fourth. Resolved, That this Conference is opposed to a general slash burning law, as experience has proven it unsatisfactory, impractical and dangerous. We recommend, however, that the Commission should be given authority to order the disposal of dangerous slashings sufficient to establish a safe fire line around standing timber or other valuable property.

Fifth. Resolved, That this Conference advocates legislation providing strict regulation of the burning of brush and debris in clearing land during the dry season, such burning to be under the direction of the State fire patrolmen under such regulations as the Commission may prescribe.

Sixth. We further recommend, that the burning of all debris on the rights of way of the various railroads be under the control and direction of the State Forest Patrol. Further, that under special conditions as directed by the State Forest Patrol the railway companies maintain a patrol, properly equipped following their trains, also that all railroad and logging locomotives and traction engines must be equipped with the most practical spark arresting devices subject to inspection and approval of the Commission.

Seventh. Whereas, The building of fire lines around exposed property including settlements, villages and towns, has proven a most effective means for the control and extinguishment of fires, we recommend, that one of the principal duties of the patrolmen working under the direction of the Commission, should be to establish such fire lines where necessary for protection of property.

Eighth. We recommend, as the most effective measures for preventing and fighting serious fires, adequate means of transportation and communication, to include trails, telephone lines and lookout stations, and that the efforts of the Commission should be exerted toward the construction and establishment of the same as rapidly as consistent.

Ninth. The appalling sacrifice of life and the continued great loss of State and private property resulting from fires in our forested area, are a disgrace to our civilization and a most serious drain upon our natural resources, and we believe that the expenditure of such amount as may be necessary to prevent these losses is fully justified.

We therefore recommend, that the appropriations by the State Legislatures to maintain forest protection should be sufficient to

provide for a Forest patrolman for each forty thousand acres requiring protection as well as for the expenses necessary to successfully carry out all of the measures suggested by these resolutions.

Tenth. We recommend, in addition to the Patrol System, an auxiliary County fire fighting force to be appointed by and under the direction of the Commission, to be paid by the State and charged back to the Counties. Such expense to be ultimately borne by the Counties or towns in which the fires occur.

Further Be It Resolved, That as it is shown by statistics that there are a large number of fires set each season through the carelessness of the general public, including campers, fishermen, hunters and others, we recommend, that a campaign of education be energetically carried on through every possible channel to the end that this hazard be reduced through a better understanding of forest conditions by all the people.

Recommendations Contained in the Report of the State Conservation Commission of Wisconsin. Submitted December 16, 1910.

1. That a state tax of two-tenths of a mill be levied and collected annually for a period of twenty years for carrying on the work of the state board of forestry.

2. That a more rational method or taxing timberlands be adopted so that it may be practicable for owners to hold growing timber on lands not primarily valuable for agriculture.

3. That an efficient system of state fire patrol be organized under the charge of the state board of forestry, and that the burning of slashings be under the charge of the same board.

4. That the cost of this system be defrayed in the first instance by state funds under the charge of the state board of forestry, and that so far as practicable the cost of the protection of forest lands, privately owned, be charged back to the owners of such lands.

Democratic State Platform of September, 1910.

The democratic party favors the conservation of all the natural resources of the state for the benefit of the many instead of the few. We believe that the resources of the state are the heritage of all and should be conserved for the benefit of all.

Republican State Platform of September, 1910.

The conservation of the natural resources of soil, forest, mines, and water power and the settlement of the uncultivated lands suitable for agriculture, are the foundations of the prosperity of the state. We pledge legislation that shall encourage the earliest and highest development of these resources, while we claim all the rights of the people in them. A general law should be passed outlining a comprehensive plan for the development and operation of water power plants and providing proper restrictions under which water power franchises may be obtained, to the end that all persons holding water power rights may be subject to the same general law. Private monopoly should be controlled by the leasing of water power on limited permits subject to regulation and valuation compensation. Prompt action should be taken to complete the forest reserve as soon as practicable and to preserve our forests from destruction by fire.

Address of Gifford Pinchot before the American Forest Congress, held at Washington, D. C., in January, 1905.

The National Forest Service has three principal objects. First, it is responsible for the general progress of forestry in the United States among the people at large, so far as the national government is concerned. This work rests upon the fact that in a government such as ours no movement can be permanently successful unless it is based on a general public recognition of its importance and utility. Since, therefore, it is essential to the well-being of the nation that its forests should not be destroyed, the first duty of the Forest Service is to place that fact clearly before the people . . . .

Not only are the forest reserves in general for use, but every individual resource is likewise to be used, under the single restriction that it shall be so used as to become permanent. Timber, water, grass, minerals, are all to be open to the conservative and continued use of the people. They must be used but they must not be destroyed . . . .

The extension of the present forest area, by restocking cut-over lands and by making plantations where there are no forests, is one of the chief duties of the present moment. This will be accomplished by the helping the States to formulate their own policies, by active co-operation in studying the local situation in each, and by recommending the best procedure under the conditions that

are found to exist. In particular, the farmers in every section of the country must be aided, either to develop their woodlots or to plant trees upon the prairies.

Speech of Henry S. Graves, Chief Forester of the United States, at the Conservation Congress at St. Paul, Sept. 5—9, 1910.

It is not my intention in this address to dwell at length on the fundamental importance to the country of forest conservation. To those who know the needs of the people for forest products, the available resources, and the manner in which ther are now being used up and destroyed, it must be clear that we are facing a problem which must be met with prompt and vigorous action.

A survey of the forest resources of the world shows clearly that in the long run this nation must be dependent chiefly upon its own supplies. Those who believe that we may destroy our own forests and then draw upon foreign resources of timber are ignorant of the facts, for those supplies will not be long available. Foreign countries will need for their own use what they can produce, and many of the exporting countries are exhausting their forests just as rapidly as America. The timber supply in this country is being rapidly depleted. We are extravagant in our use of forest products; there is waste in logging and manufacture, and the loss by fire is a shame to the country. To offset this reduction of merchantable resources the annual production of timber by growth amounts to much less than one-third the average quantity used and destroyed. In other words, we are actually using up our forest supplies.

PROPOSED FOREST PROTECTIVE LEGISLATION.

All thinking people realize that the wonderful forest wealth of this country cannot be conserved through wise use until the government, the states and private owners are willing to spend the large sums that will be necessary to stop the annual and appalling loss from forest fires. This country is growing out of its irresponsible boyhood days, with its reckless waste and utter disregard for the future, and as it has grown older, and as elbow begins to rub elbow with the enormous increase in population, we are beginning to learn a truth long known in older countries, that the state in order to do its duty to all its citizens must use its general police powers much more freely than in the past, and that the selfish interest of the individual must give way to the infinitely greater good of the whole people.

The United States census of 1900 gave Wisconsin the proud position of ranking first among all the states in the production of lumber. The census of 1910 will show that Wisconsin has fallen back in these ten years to eighth place, and that her production of lumber in the same period of time has decreased 40%, which is more than that of any other state. The wood using industries of the state, not counting the sawmills, use annually over 930 million board feet of lumber, valued at $20,000,000, but the state will lose these industries, and many others even more important, as sawmills, paper and pulp mills, etc., unless all forms of needless waste are stopped, and certainly forest fires are the most useless and needless forms of forest waste.

The Lake States Forest Fire conference, held in St. Paul December 6th and 7th, 1910, proved that the severe fire losses of 1910, following the even greater losses of 1908, have aroused us all as never before, and if our legislature can truly appreciate the situation, they will not fail to act. Let us see what the fire losses have been in Wisconsin.

In 1908, according to the reports of our fire wardens, 1,200,000 acres were burned over, and the loss in timber and young growth amounted to $9,000,000. For 1910 our reports, which are not

fully complete, show that 892,833 acres were burned over and the loss in timber and young growth amounted to over $5,000,000, thus making a total loss for 1908 and 1910 of $14,000,000 or enough to pay for an adequate forest fire patrol for 45 years. The direct loss of merchantable timber, however, is not by any means the most serious in its lasting results, but rather the loss of the industries that depend upon the forests for their raw material, and the still greater ultimate loss through the destruction of young, growing timber, upon thousands of acres, which are burned over every year. Wisconsin has a wealth of fertile land awaiting cultivation, but she also has large areas more valuable for forest growth, and the people of our state do not as yet begin to appreciate the great future value of the young timber upon such lands, and the careful protection that such small timber needs. Mature merchantable timber that is burned can often be cut and so saved, but young timber when burned is almost always a total loss.

At present Wisconsin has the following system of town fire wardens: The State Forester is authorized to appoint as many fire wardens in each organized town in the state as he deems necessary, and we now have over 500 fire wardens in the northern or forest portion of the state. These fire wardens post notices, have authority to call upon any person to assist them in fighting fire, are given the same authority as sheriffs to arrest without a warrant, and when in their judgment a dangerously dry time exists, and it is unsafe to set fire for clearing land, or for any other purpose, they have the authority to post special warning notices, forbidding the setting of any fires. The fire wardens, and the men called out by them, are paid by the town boards for the time that they actually serve, at a rate not exceeding 25 cents per hour, but the total amount that can be expended annually is limited to $100 per township, or 36 sections. It will be noted that the fire wardens have a considerable amount of authority, and as the best available men, irrespective of politics, have been appointed, they have put out thousands of small fires and thus averted much heavier losses, but the whole system is faulty from the fact that it is based upon the plan of putting out fires after they occur, while it is now becoming a well known truth that the greatest efforts in forest protection should be centered upon fire prevention.

It must have been an old forest fire fighter who coined the ex-

pression "An ounce of prevention is worth a pound of cure" and probably he had seen as we nearly all have, a small neglected blaze fanned and spread by the winds until it became a fire of such proportions that men were powerless before it.

The present limit of expense in fighting fire of $100 per township is absolutely inadequate in very dry years, such as 1908 and 1910, and the time when the wardens are needed the most is not the time to have the financial cog of the system break down.

Theoretically, the plan of allowing fires to be set at any time, except when the local fire warden posts notices forbidding any fires, is correct, for it imposes the least possible interference with individual rights and especially the clearing of forest lands by settlers in order to make farms, which is of course so necessary, provided it is done at the proper time, and in the proper manner, so as to avoid the wide destruction of the past. Such enormous damage has been done in Wisconsin during the last six years, through fires set by settlers in clearing land, and it is so difficult to secure convictions as the settler can merely claim that he did not see the special warning notices forbidding the setting of fires, that we feel we have the cart before the horse and that a radical change in the law is demanded.

We must prevent as far as possible the starting of forest fires, and therefore the State Board of Forestry of Wisconsin has decided to urge upon our legislature the great importance and necessity of providing a forest fire patrol in northern Wisconsin, upon the following lines:

A Chief Forest Fire Patrol, appointed by and under the supervision of the State Board of Forestry, with headquarters at some central point. He should be a practical woodsman, with a wide knowledge of the northern part of the state, and the ability to handle men. He should be supplied with an office and such clerical help as may be necessary.

In each of twenty-two or more of the northern counties, there should be located at some central point a Head County Fire Patrol, in charge of the work in his county. He should be under the direct orders of his chief, report to him weekly, be obliged to keep one or more saddle horses, and should cover every part of his county at stated intervals.

Under the direct supervision and orders of the Head Patrols in each county, would be County Forest Fire Patrols, varying in number according to the size of the county, and the amount of

forest land to be protected, but sufficient in number so that each man would not have over 40,000 acres of land to patrol. For the twenty-two northern counties that it is proposed that the patrols shall cover, it is expected that at least 322 men will be required. The plan is that all these men shall be secured from lumber companies who operate only in winter, as thus their best men would be given work every summer, the state would secure the services of trained woodsmen, and both the state and the lumber companies would gain the great advantage of having permanent men upon whose ability they could count. Each county patrol would have a given territory to look after, for which he would be responsible, would live in a cabin or shack, and whenever possible would be mounted, so as to patrol quickly, and get to a fire with the least possible delay. The county patrols should be instructed to at once call upon every settler in their territory, explain the fire laws thoroughly, and in every way try to make the settler appreciate that they are working for his interest and want his hearty co-operation.

As soon as funds are available, telephone lines should be built to connect all the patrol camps or cabins, so that the head patrol could call all his men together at any point in the county to fight fire, and wherever possible watch towers should be built, where men would be stationed in dangerously dry times to immediately report signs of fire in any direction. Such watch towers have been built by the lumbermen in Maine and have proved very useful.

During wet seasons when there is practically no danger from forest fire, the head patrol in each county should call his men together and clear up old logging roads, logging railroad rights of way, trails, etc., so that they could be used as fire lines. This is very important as our experience in fighting fires for the last few years has proved over and over again that the men are seriously handicapped in checking fires promptly, from the fact that there are so few roads that are kept clear of brush, and therefore they have no fire line to fall back upon in case of necessity. Much good can also be done by felling old snags, which are the means of spreading fire to a great distance in a heavy wind, and also by burning at favorable times heavy and dangerous slash where it is a constant menace to adjoining timber or other property.

In this connection it should be noted that it is proposed to include in the law an important provision giving the State Board of

Forestry power to order the burning of dangerous slash, so as to provide a reasonably wide strip next to adjoining property that is menaced by such slash, and that if the owner of the land or the timber fails to comply with the order of the Board within a specified and reasonable period, the State Board of Forestry shall burn such slash, the cost thereof to be a first lien upon the land or timber. If the state of Wisconsin is not to have a general slash burning law, it is absolutely necessary that the state, through some board or commission, should have the right to determine when and where slash is such a public nuisance that it must be destroyed. In this way eash case can be carefully considered and the law, if enforced fairly and efficiently, should be a very effective means of forest protection.

One of the most important provisions of the proposed law is to provide that no fires shall be set by any one from April first to December first (except for warming the person or cooking food) without a written permit from a patrol or fire warden. This would mean that any fires set for the purpose of clearing land, burning brush or slash, without a written permit, would be absolute evidence of violation of the law, sufficient to secure conviction. The objection may be raised that the settler is obliged to use fire very freely in order to make a farm on land covered with young timber, brush and slash. This is of course true, but our records of forest fires in Wisconsin for the last six years show that from 40 per cent to 70 per cent of all the fires have been caused by settlers burning brush. A large proportion of the settlers in the forest regions of the state are grossly negligent in the use of fire, and often apparently indifferent to the damage they may cause to the property of others. They frequently select the driest and most dangerous times to start their fires, and fail to take reasonable precautions to prevent the fire spreading.

Under the proposed plan, the local patrols and fire wardens would be authorized, as agents of the State Board of Forestry, to issue permits to set fire when it was safe to do so, and the patrols would be instructed to assist new settlers by showing them how to burn safely and be directed to use their authority reasonably, so as to secure the co-operation of the settlers. Campers, hunters and fishermen must be allowed to build fires at any time, as this is necessary both for cooking and warmth, but the patrols should keep in close touch with all such parties

and arrest them promptly for leaving a camp fire unextinguished.

It will be noted in this proposed plan that the patrols are intended to prevent in every possible way the starting of fires. They will, of course, be a well organized body to fight fires when they occur, but their first and main duty will be to prevent fires starting. However, under the best possible system some fires will always occur, and in order to have an auxiliary force, under the direction of the patrols, which they can call in time of necessity, it is proposed to appoint county fire wardens and do away entirely with the present system of town fire wardens. Many of the town boards have seriously handicapped the work of the wardens by failing to promptly pay the wardens, and the men called out by them. Men will refuse to fight fires if they are obliged to often wait a year for their pay. Most town boards are also strongly averse to allowing any pay if their wardens help to fight fire in adjoining towns, though such fires may at any time destroy much valuable property in their own town. Therefore, it is necesary in order to secure good results to appoint the wardens for the county, instead of the town, and give them full authority to fight fire anywhere in their own or adjoining counties. The present limit of $100 per township, or 36 sections, for fighting fire is entirely inadequate, and therefore it is proposed to increase the limit that any county may expend in any one year to $300 per township. Thus, if a county contains 20 townships it could expend a total of $6,000 in fighting fire, but it should also be provided that the county board of supervisors could exceed this amount in cases of great necessity.

In order that the fire wardens and the men called out by them shall be paid promptly, it is proposed that the state shall pay the men and collect the expense from the counties. The patrols should keep in close touch with the wardens and arrange with them as to the men who should be called out in case of fire, and thus build up a well trained organization for the control of forest fires.

Wisconsin now has a forest reserve of some 340,000 acres, largely upon the headwaters of the Wisconsin and Chippewa rivers, but in order to protect this important watershed, preserve this beautiful lake region as a summer resort for the citizens of Wisconsin, and other states, and also to have a forest reserve large enough to be a factor in supplying the wood using industries of the state with timber, the State Board of Forestry

will urge the necessity of acquiring a forest reserve of approximately 2,000,000 acres. The land must be purchased and in order to raise the necessary funds for the creation of an adequate forest reserve, including its protection and improvement, and also to pay for the fire patrol system in northern Wisconsin, the legislature will be asked to grant the State Board of Forestry the proceeds of a 2-10 of a mill state tax for a period of twenty years. This general state tax will yield a yearly revenue of approximately $600,000, and it is estimated that the cost of the patrol system will amount to $250,000 per year. However, the amount which may be expended in the patrol system should be extremely elastic in order to meet varying conditions, and the forestry board should be authorized to expend the entire income of the department if it was found necessary to do so, in an unusually dry and dangerous year.

At first glance, $250,000 may seem a very large amount to expend annually for forest fire patrols, but in the 22 counties which it is proposed to patrol, there are about 13,000,000 acres of wild or unimproved lands, most of which are covered with some kind of forest growth, so that the cost would be from 2 to 3 cents per acre, and if the patrol system is at all successful, in protecting property, the cost will really represent a very low rate of insurance.

The American people as a whole are uncivilized in their apparently stoical indifference to the appalling annual losses from forest fires. The problems involved are tremendous ones, but they can be solved if only the nation, state and individual care enough to devote the hard work and large sums that will be required. The fearful destruction of the forests in 1908 and 1910 leads me to hope that the time of mere talking is drawing to an end, and that now real action to save our forest resources will commence.

A STATE TAX OF TWO-TENTHS OF A MILL FOR FIRE PATROL AND PURCHASE OF FOREST RESERVE LANDS.

Both the special legislative committee on water powers, forestry and drainage, which was appointed in 1909 to investigate these subjects, and the state conservation commission, recommend that an annual state tax of 2-10 of a mill be levied and collected annually for a peirod of twenty years, and that the State Board of Forestry is authorized to use the proceeds for a state forest fire patrol, and for the purchase of lands to be added to the state forest reserves and for their protection and improvement.

In 1905, through the enactment of chapter 264, the state took the first step towards a broad and comprehensive policy to gradually acquire adequate forests reserves at the headwaters of the most important rivers of the state. This law withdrew from sale and set aside for forest reserve purposes all state lands north of town 33, and the most effective provision of the bill was that the State Board of Forestry might dispose of the agricultural and scattered lands, not suitable for forestry, the proceeds of such sales to constitute a "forest reserve" fund to be available for the purchase of lands to be added to the forest reserves.

The state lands north of town 33 that remained unsold in 1905, were so badly scattered that they could not be systematically managed as forest reserves, or adequately protected from fire and timber trespass. The State Forester, therefore, after examining the lands and consulting with the higher officers of the U. S. Forest Service, recommended to the State Board of Forestry that the main forest reserve be located in the wonderful lake region, lying at the headwaters of the Wisconsin and Chippewa rivers in Oneida and Vilas counties, and that the agricultural and scattering lands in other counties should be appraised and sold, at public sale, at such times as the lands and timber could be disposed of to the best advantage. In 1905, the state lands in Oneida and Vilas counties comprised 50,347 acres, and

up to January 1st, 1911, the State Board of Forestry has purchased 62,919 acres in these two counties, so that the present acreage is 113,266 acres. In addition to these lands there are some 35,427 acres in Forest county, 29,910 in Iron county, and 27,474 acres in Price county, most of which will be retained within the permanent reserves, so that the foundation of our future forest reserves is now 206,077 acres. There remain some 91,492 acres of agricultural and scattered lands to be disposed of in other counties, and they are being offered for sale.

The sale of these remaining lands, however, will not begin to provide sufficient funds to purchase the lands that it is absolutely necessary to procure in order to block up the reserves and thus make forestry management possible. As previously stated, the lake region in Oneida and Vilas counties, at the headwaters of the Wisconsin and Chippewa rivers, is very unusual in the number, extent and beauty of the lakes. Those lakes also have a very important economic value, for if the forest growth upon their watersheds is protected, and some of the lakes also used as reservoirs, the flow of the rivers rising in this region can be made remarkably uniform, and thereby the value of these rivers, both in the development of power and for any possible future needs of navigation, will be assured to the people of the state for all time.

But this lake region, which is such a valuable asset to the state, cannot be protected until the necessary lands are acquired and placed under forestry management. The cut-over lands that are adjacent to, and mixed in among, the state's holdings, owned largely by non-residents and uncared for, are a serious and constant menace to the forest reserves, as they are the source from which start many of the destructive forest fires. The truest economy on the part of the state will be to acquire these lands as soon as possible, so that the young growth that is coming up may be protected and denuded lands reforested.

The State Board of Forestry has secured the 62,919 acres, already purchased in this region, at the very low average price of $2.50 per acre, but timbered lands, which should be secured to protect the shores of the rivers and lakes, and which will prove to be most profitable investments, cannot, of course, be purchased at such a low figure. The Board has, during the past five years, examined the areas that should be purchased and it has been found that the state should own and control at least

2,000,000 acres in forest reserves. It is the intention to appoint forest rangers who will live in the reserves, act as fire patrols to prevent the setting or spread of forest fires, build fire lines, roads and trails, plant areas that have been denuded, and scale the mature timber that is cut from reserve lands by the purchasers.

As stated, the lands necessary to block up the reserves should be purchased as soon as possible, and an organization perfected so that the reserves shall be brought into condition to yield an increasing revenue to the state. Therefore there is urgent necessity for the passage of the bill introduced in the legislature of 1909 as No. 502, S., so amended as to provide a state tax of two-tenths of one mill for each dollar of the assessed valuation of the taxable property in the state, to be collected annually for a period of twenty years, the tax when levied and collected to constitute "a forestry investment fund," to be used for the purchase, improvement and protection of forest reserve lands and for a forest fire patrol. Such a tax of two-tenths of one mill will make it possible for the State Board of Forestry to at once enter into land contracts to secure the lands that are needed and to pay for them as the money becomes available.

This may appear to be a large sum to devote to forestry work, but it should be remembered that the purchase of forest reserve lands will be a most excellent investment for the state for the following reasons:

1. The young timber on the reserves will be protected and denuded acres planted so that in future years the state will receive a direct and increasing revenue from the sale of mature timber, which can be cut and removed from time to time, and at the same time improve the character of the forest.

2. Indirectly the state will receive even a greater revenue by retaining industries within the state that will become more and more dependent upon the forest reserves for raw material as the forests are cut off of private lands.

3. In the same way the state will gain an indirect revenue from the preservation and improvement of the water powers, which will be assured by extensive forests at the headwaters.

4. Preserving the forests in the beautiful lake regions of northern Wisconsin will both protect and greatly enhance its present attractiveness as a resort region, for not only the citizens of this state but of the entire Mississippi valley as well. The value of such a resort region is not generally understood, even from the

dollar view-point, but the report of the bureau of labor of New Hampshire for 1905 shows that the resort business yielded in that year over $10,000,000, and the report of the Forest, Fish and Game commission of New York for the same year states that it was over $7,000,000.

If we protect our lakes, rivers and forests in northern Wisconsin, they will attract summer visitors from all over the country, and not only will the settlers have a near and ready market for all they can raise, but a large amount of money will be paid to hotels, boarding houses, resorts, guides, etc.

It will also be desirable to set apart a portion of the reserves as a bird and game preserve.

As will be noted from the following statements both New York and Pennsylvania through generous annual appropriations are rapidly acquiring splendid forest reserves, which they appreciate are investments that will constantly increase in value.

New York.

Forest Reserve Lands.

Purchased, 1907	46,156 acres
Area, 1908	1,548,450 acres
Purchased, 1908	63,367 acres
Area, 1909	1,611,817 acres
Purchased, 1909	43,943 acres
Total	1,655,760 acres

Appropriation, 1908, for purchase of lands, $603,516.

Pennsylvania.

Forest Reserve Lands.

Area, 1904	549,563 acres
Area, 1906	701 297 acres
Contracted for in 1906	100,000 acres
Total	801,297 acres

Appropriation for 1907 and 1908, $600,000.

WISCONSIN WOOD-USING INDUSTRIES.

The following is a very brief and necessarily incomplete outline of the report on "Wisconsin Wood-Using Industries" prepared by Franklin H. Smith and H. S. Sackett of the Federal Forest Service, in co-operation with this department. The complete report can be secured from the State Board of Forestry, Madison, Wis.

INTRODUCTION.

The importance of Wisconsin as a lumber producing and a lumber consuming state has been long apparent, as evidenced by the industrial data gathered for the entire country, though less information concerning the consumption of forest products in the state has been gathered than in the matter of the production. For several years the commonwealth, through the agency of the State Board of Forestry has been urging protection of its forest lands as well as reforestation for the purpose of prolonging the life of the lumber business and increasing the number of industries wherein wood in its various forms enters exclusively or partially into the manufactures. Data showing the number, character, and variety of the products of the wood-using concerns located within the state, and the expenditures for raw material for these products, were not available, and it was with the view of compiling and publishing these data that the State Board of Forestry entered into co-operation with the Office of Wood Utilization of the United States Forest Service for the purpose of collecting them.

Statistics covering the production of lumber and other products of the saw mill and woods of the United States are compiled and published annually by the bureau of the census in co-operation with the Forest Service. In 1860 Wisconsin ranked seventh in the list of states arranged according to the quantity of lumber produced. Ten years later fourth place was occupied, third in 1880, second in 1890, first in 1900 and 1904, second in 1905, third in 1906, and fifth in 1907 and 1908. For the last mentioned

year, figures were furnished by 899 sawmills in Wisconsin, reporting a total production of 1,613,315,000 board feet, or 4.9 per cent of the total output of all the mills in the country. Though showing a decrease in production in comparison with the figures of the preceding year, 1907, Wisconsin retained its relative position among the states for production. The cut of white pine in the state has decreased largely in the last few years, though this loss in production has been offset by the increased output of hemlock and hardwoods. The state ranked second in the cut of white pine, first in hemlock, third in maple, first in birch, basswood, and elm, fifth in ash, and second in tamarack in 1908.

In view of the position of the state as a producing territory, the reports of the wood-using industries should be of much value both to lumber manufacturers and lumber consumers. The figures given in the report indicate the volume of each kind of wood grown both in and out of the state which is used by wood-consuming factories. A comparison reveals the importance to the dependent industries of perpetuating the home supply.

In the report consideration is given only to the use of lumber which by machinery or some other process has been changed in form either wholly or in part from the rough material. No effort was made to embrace in the report that volume of lumber which by mere shaping by hand or tool becomes a part of a structure without first having passed through some stage of manufacture. While sash, doors, blinds, and interior and exterior finish might possibly be construed as an integral part of a building, these products for the purpose of the report have been included as finished manufactures.

Individual reports were asked from all wood manufacturing plants listed in current directories, and this work was followed by personal requests for information where such action became necessary. Generally, the data was furnished without hesitation on the condition that no publication of the figures would be made in such a manner as to reveal the business of any concern.

An attempt was made by providing space on the inquiry form used to collect the data, to ascertain from the manufacurers what methods were employed to utilize waste material. Presumably the difference of opinion which exists as to what constitutes waste, resulted in so few definite replies. Reports received from many manufacturers would indicate that the small pieces left

after lumber is cut up at the factory and which are used as fuel are not considered as waste, though it is open to question whether closer utilization of lumber and the use of some other fuel would not prove more economical. The growing employment of dimension stock in furniture and chair factories and by the makers of vehicles and agricultural implements has done much toward lessening the waste at the consuming end. However, inspections made in various factories show a waste of from 5 to 35 per cent of the total volume of lumber consumed, and a conservative estimate places the average waste at 20 per cent. It is believed that this proportion of waste of raw material in many factories could be reduced by working up the cuttings which now go into the firebox or disposing of the material to some manufacturer who is in a position to utilize it in turning out a product of smaller size. The introduction of box factories as adjuncts to sawmills has materially decreased the waste of lumber at many mills.

As an illustration of how large concerns are utilizing what has heretofore been considered waste, the case of a prominent concern in its operation of a sawmill and chemical plant may be cited. After the timber suitable for manufacturing lumber is cut on the tracts owned by the company, all the small and defective hardwoods are felled and together with the tops of the trees down to a 1½ inch limb are cut into lengths easy to handle and hauled to the chemical plant. The wood is then treated and from one cord is secured 60 bushels of charcoal, 10 gallons of wood alcohol, and 145 pounds of acetate of lime. Not only does the company enjoy a source of income from this phase of utilization, but the removal of the slash does much to prevent fires and promotes reforestation or settlement to agriculture as desired.

Through the establishment of the Forest Products Laboratory at Madison, Wisconsin, plans are being worked out by the State Forester for an extended inquiry into the closer utilization of waste, with a view of increasing the profits of the lumbermen and the saving in cost of raw material to the various industries. The faculty of the University of Wisconsin contemplate introducing courses in the training of young men in wood utilization so that within a few years men having intimate knowledge of the qualities and uses of woods may be at the service of the manufacturers.

The State Board of Forestry expects to supplement at an early date the data which has been gathered in this report, by a census of the standing timber in the state. With knowledge of the needs of the manufactures and knowledge of the timber resources, a rational forestry policy can be outlined so that the producing and consuming industries dependent on wood may be perpetuated and enlarged. Not only is it desirable to conserve the forests of the state for their products, but to secure forever the maintenance of the immense water powers on the Wisconsin, Chippewa, Eau Claire, Fox, Menominee, St. Croix, Wolf, and other rivers through the protection of the watersheds.. It has been shown by recent investigations carried on by engineers that the water powers of the state approximate one million horsepower, developed and undeveloped—a tremendous natural resource that means much to the commercial life of the commonwealth.

Wood-Using Industries of Wisconsin.

Chiefly by reason of its proximity to raw material, its excellent shipping facilities by rail and water, its geographical position in relation to consuming markets, and the existence of skilled labor, Wisconsin assumes an enviable position among the states wherein wood forms a large part of the manufactures. An inquiry into the wood-using industries of the Badger state reveals the fact that more than 930 million board feet of lumber valued approximately at $20,000,000 is utilized annually in the numerous lines of manufacture carried on. This is but part of the lumber industry of the state, as the figures given do not include the vast volume of material turned out by the sawmills as well as other forest products which are not considered as raw material for further manufacture. The value of the raw material only is set forth; were the labor expended upon it and the cost of other materials with which the lumber is combined, included, however, the total value of the finished products would soar into additional millions. Of the 930 million feet reported, a little more than one-half of that quantity originated in the state. The figures by no means represent the total amount of wood used, as finished products such as staves and heading used by the cooperage trade and complete wheels and gear used in assembling carriages and wagons were not included in the investigation. Neither was there included in the totals the heavy volume of

lumber that goes into flooring, ceiling, siding, and other products of the planing mill.

Forty species, some native to foreign countries alone, are shown in Table I, which follows, exhibiting the quantity of each wood used, the total cost at the factory, and the per cent grown in and out of the state.

TABLE I.—KINDS OF WOOD USED, QUANTITY OF EACH, WITH TOTAL COST AND THE PER CENT. GROWN IN THE STATE AND OUT.

Species.	Feet used. B. M.	Cost at factory.	Grown in Wisconsin. (Per cent.)	Grown outside of Wisconsin. (Per cent.)
Spruce	164,458,000	$3,123,593	28	72
Western Pine	79,220,000	2,484,155	.....	100
Oak, red and white	55,349,000	2,259,691	29	71
White Pine	101,029,000	2,051,020	71	29
Hemlock	150,698,000	1,814,405	67	33
Basswood	77,054,000	1,444,612	90	10
Birch	75,181,000	1,316,139	88	12
Maple	49,786,000	1,125,356	52	48
Elm	38,180,000	881,346	77	23
Yellow Pine	21,099,000	638,369	.....	100
Ash	14,249,000	377,194	80	20
Cypress	9,679,000	352,948	.....	100
Oak, quartered	5,095,000	342,002	10	90
Hickory	5,075,000	311,225	.....	100
Poplar	13,112,000	306,220	61	39
Balsam	26,060,000	286,329	55	45
Cottonwood	5,804,000	256,217	.....	100
Douglas Fir	5,002,000	180,815	.....	100
Norway Pine	7,505,000	124,350	84	16
Beech	6,431,000	106,485	43	57
Western Spruce	3,287,000	101,319	.....	100
Gum	3,497,000	85,385	.....	100
Chestnut	2,898,000	74,206	.....	100
Mahogany	500,000	71,955	.....	100
Jack Pine	5,150,000	58,850	76	24
Tamarack	2,480,000	25,924	90	10
Tupelo Gum	855,000	20,075	.....	100
Spanish Cedar	105,000	17,990	.....	100
Cedar	310,000	11,140	63	37
Cherry	153,000	10,160	.....	100
Butternut	610,000	9,230	100	.....
Walnut	72,000	5,300	.....	100
Redwood	113,000	4,740	.....	100
Sycamore	155,000	4,240	.....	100
English Oak	16,000	3,500	.....	100
Red Cedar	40,000	2,109	.....	100
Circassian Walnut	5,000	1,750	.....	100
French Walnut	5,000	1,000	.....	100
Willow	100,000	970	100	.....
Rosewood	1,000	500	.....	100
Total	930,382,000	$20,293,034*	51	49

* The average price per thousand feet for all the lumber reported was $21.81.

Table I shows that of the 930,382,000 feet used, at a total cost of $20,293,034, 51 per cent of the total quantity, or 474,494,820 feet, was cut from the forests of the state and 49 per cent, or 455,887,180 feet, was cut in other states or countries. When the figures on the quantity grown in the state and out are considered in connection with the position Wisconsin holds in comparison with other lumber producing states, a discrepancy seemingly appears. However, it is partially explained by the fact that 72 per cent, or 118,204,000 feet, of spruce (Picea mariana) and 79,220,000 feet of western pine used, is credited to the volume of wood cut in other states, and which greatly swells the total amount of lumber imported into the state. The term "western pine" as given in the table includes the several species of pine grown in the Rocky Mountain and Pacific Coast states, and embraces the true western white pine (Pinus monticola), the sugar pine (Pinus lambertina), and the western yellow pine (Pinus ponderosa), it being impracticable to segregate them under certain commercial conditions. While Wisconsin produces sufficient white pine to meet the needs of its manufactures, the cheapness of the western pine and its quality has resulted in its wider use, particularly in the sash, door and millwork industry. Of the native woods, 67 per cent of the hemlock, 90 per cent of the basswood, 88 per cent of the birch, 52 per cent of the maple, 77 per cent of the elm, 80 per cent of the ash, 100 per cent of the butternut, and 84 per cent of the Norway pine used, originated in the state. As a matter of fact the manufacturers of the state draw their supplies of lumber from every section of the country, freight rates permitting the stock to be turned into finished products and these products shipped in many instances into the same sections from which the material was drawn.

THE TAXATION OF FOREST LANDS IN WISCONSIN.

The following is a synopsis of the exhaustive report prepared on this subject by Alfred K. Chittenden and Harry Irion of the U. S. Forest Service, in co-operation with the State Board of Forestry, and with the assistance of the State Tax Commission. The complete report will be published and can be secured from the State Board of Forestry.

INTRODUCTION.

On the initiative of the Wisconsin State Board of Forestry the Forest Service of the United States Department of Agriculture in April, 1910, entered into a co-operative agreement by the terms of which it was to undertake a study of forest conditions in the state of Wisconsin.

The main purpose of the study was to determine the extent of the burden now carried by timberlands as a result of the present methods of taxation, and what influence, if any, such methods of taxation have or will have on the practice of forestry by private owners.

That the perpetuation of this country's forests, and their management along conservative lines, is an object of grave concern to the nation and to individual states, and a proper subject of legislation, all admit. Nor will it be denied by those having a proper regard for the future, that the time has arrived when affirmative action must be taken if this end is to be attained. Every day of delay lessens the chance of success.

Forest conservation by private owners depends primarily upon one point: Does it pay? If forestry can not be made to pay without granting it special favors it has no place in the business world of today. The two great obstacles to the practice of forestry by private owners are forest fires and an unjust and unequal system of taxation. Without proper control of the forest fires that yearly run over the cut-over lands, no private owner can hold his cut-over lands for a second cut. Without a fair system of taxation no private owner can hold his cut-over lands

and give them adequate fire protection in order to get a second cut of timber. With a fair system of taxation, owners of timberland will be better able to protect their cut-over lands from fire, and can, perhaps, afford to hold these cut-over lands for future timber production.

A study of forest taxation has already been made in New Hampshire, and the report has been published by the Forestry commission of that state in its biennial report for the years 1907–08, but up to the present time no such study has been made in the Lake states. While the general conclusions reached in New Hampshire may in a way be applicable to other states and regions, they can not be applied *in toto*. Local conditions and present methods of taxation, the relative area of forest land, the rate of growth of the forest, as well as other considerations, must be taken into account.

Wisconsin stands fifth in the list of timber-producing states of the Union. In 1907 it was fourth. In 1908 it ranked second in the production of white pine. It is being rapidly drained of timber by lumbering, but timber removed in this way is converted into money and brings about the development of the country. Very large areas in Wisconsin, however, are being stripped of timber in another way—by fire. In 1908 an area of 1,209,432 acres was burned over by 1,435 forest fires. No small portion of this acreage was young growth pine, hemlock, spruce, and hardwoods, some of it nearing merchantable size, while the proportion of mature timber burned was also large. It is estimated that 499,495,791 board feet of merchantable timber were destroyed, worth, at a conservative estimate, $2,996,975. The value of the young growth destroyed by these forest fires in 1908 is estimated at $6,047,060.

Wisconsin is typical of the great region around the lakes. The northern part of the state is largely white pine land; south of this is found a wide extent of hardwood land; and the southern portion of the state ranks with the best agricultural land in the United States. A study of forest taxation, then, in Wisconsin will be applicable to a wide territory, and the conclusions herein reached may be applied to a territory larger than the state alone.

The study was confined largely to the northern part of the state. The southern part is principally farming land, and the value of the soil for farming is greater than it could possibly be for timber production. Practically all of the timber has been re-

moved from the southern counties, and there remain now only scattering bodies of timber included in the woodlots of the various farms. The northern part of the state, however, contains much true forest soil—soil that is too poor, rocky, or sandy to ever be successfully used for agriculture. In many of the intermediate counties, however, the soil is suitable for agriculture and will undoubtedly be so utilized within the next few decades. But the country is comparatively unsettled as yet, and while awaiting the coming of farmers and the conversion of the land into farms, it can and should be used for the production of timber. This applies to counties such as Price and Rusk, where practically the entire county contains excellent farming soil, but where settlement is naturally slow, owing to the difficulty in clearing the land for agriculture. In these counties the standing timber will soon be exhausted, and the timberland owners are now offering much of their land for sale to settlers. There are extensive areas in these counties, however, where the soil is too rocky and poor for farming, and such areas should be kept in timber growth. In the extreme northern counties where the soil is sandy it has no value except for forest growth.

The general conclusions that may be drawn from this investigation are:

1. The actual tax burdens imposed on forest lands of the same value are not uniform or proportionate, as the constitution and laws of the state require, either as between the different counties and towns or between the different taxpayers in the same town.

2. The burden of taxation upon cut-over land is relatively much higher than upon timbered land, although the latter is better able to bear the heavier burden of taxation.

3. The burden of taxation upon farm land is also relatively less than that upon cut-over land in the same towns, although its actual value is far greater. The ratio of the assessed to the true value of farm lands is practically the same as for timbered lands.

4. In general, the laws regarding taxation have not been strictly enforced. That no strong objections have been raised to the taxes on forest land by timberland owners is due to the fact that timberlands have in the past been greatly underassessed, and while the tax rates have been extremely high in many cases, the burden of taxation upon the timberland is just beginning to be felt.

5. In the search for revenue to meet the financial necessities of the towns a strong tendency has recently developed to enforce the law more rigidly, and valuations have in many cases been greatly increased. This increase in valuations is more noticeable upon timbered land than upon cut-over or farming land. The cut-over land is already being assessed at practically its actual value, or even higher.

6. The present law, granting total exemption for thirty years to farmers who have planted their land to timber, is not being taken advantage of to any extent, and there are no records of any advantage having been taken of the old law, now repealed, allowing bounties to farmers who planted shelterbelts.

7. Owing to the great danger from forest fires in the state of Wisconsin, to the length of time required to secure returns from cut-over lands by waiting for a second cut, and to the cost of protection in the meanwhile, forest management is not a particularly tempting investment for timberland owners, especially in view of the fact that cut-over land can be sold to settlers at a good price. For this reason it is believed that the state's forest policy should be greatly extended and strengthened.

8. The fire-patrol system at present in force in Wisconsin, while excellent as far as it goes, is not sufficient to successfully contend with forest fires during any particularly bad fire season. The fire patrol system should, therefore, be greatly strengthened, and non-residents employed as fire wardens if possible.

The work upon which this report is based was confined principally to the northern portion of the state, since it was manifestly impossible to go thoroughly over the entire area. Moreover, the results of an investigation in every county would not have yielded any more complete or reliable data on the tax question than could be obtained by a selection of typical counties. As has been already stated, the southern part of the state is a well-developed farming country, and the question of forest taxation has little bearing there except in its application to farm woodlots. For this purpose one southern county, considered to be typical of many—Jefferson county, was selected, and an examination of that county was made to determine the effect, if any, of the present tax laws on woodlot conditions. For the rest the work was confined to the northern part of the state. Certain counties, however, such as Marathon, are well settled, and there are large areas of prosperous farms throughout. While it is

probably true that a large proportion of this northern region contains soil suitable for agriculture or that dairy farms will be established, yet there are large areas of soil too poor for farming. On such soil timber growth will always be the best crop.

For the purpose of this study ten counties considered typical of the northern part of the state were selected for detailed study. These were Bayfield, Douglas, Florence, Forest, Iron, Marinette, Price, Rusk, Sawyer and Vilas counties. While all the information possible was collected in the other counties of the state, the principal work was confined to these ten counties.

Cut-over Land.

About 60 per cent of Bayfield county, 95 per cent of Douglas county, 50 per cent of Florence county, 20 per cent of Forest county, 45 per cent of Iron county, 75 per cent of Marinette county, 67 per cent of Price county, 78 per cent of Rusk county, 65 per cent of Sawyer county, and 78 per cent of Vilas county has been cut over. Or, to express it in another way, out of a total area of 6,518,560 acres for these counties, the timber has been cut from approximately 4,254,000 acres. A large part of the remainder, however, has also been more or less heavily culled over for pine. Much of this cut-over land is owned by land companies who are trying to dispose of it to settlers at from $10 to $18 per acre. In some of the counties, however, some of the larger companies are not selling their cut-over land, although they are not holding it for a second crop. Presumably they are retaining title to it in order to continue in control of the town government, thereby making it possible to keep the taxes on their timbered land at a minimum. Not until they have completed operations will these cut-over lands be placed upon the market. While it is not probable that any great amount of it can be sold to settlers, the lumber companies will have little trouble in disposing of it at from $2 to $4 per acre to land companies.

The bringing into use of this great quantity of cut-over land, the bulk of which is now in a state of idleness and likely to continue so under present conditions, is a problem of first importance. Eventually much of it that is fit for agriculture will doubtless be placed under cultivation. Its rapid appropriation for farming, however, is not probable. Through unfortunate lack of information many of the settlers purchase land that is so poor

in soil that, even after valiant efforts, they fail to develop it, and finally are compelled to let it go. Not infrequently the land is sold to the poor but well-intentioned non-resident without his having had an opportunity to view it. Often, in such cases, the land that he has purchased is not fit for farming purposes, and the result is abandonment. These cases are cited merely to show some of the elements that are tending to defer the early development of that part of the cut-over area which is susceptible of cultivation.

The most serious phase of the problem, however, is to bring about a utilization of the non-agricultural land. It is not worthless land by any means, for it can be successfully used for growing timber. It is essentially a forest soil and should unquestionably be kept under forest growth. At present the greater part of it is nothing more than waste, and what is worse, the owners could not profitably make it a timber-producing property even if they were so inclined. This class of land, as will be shown, is bearing the heaviest tax burden, and more than any other is entitled to consideration in any plan for an equitable adjustment of taxation. It is this land that should furnish a good part of the future local timber supply, and in order that this may be made possible through private initiative, one of the first steps that should be taken is to provide a rational forest tax law.

Annual Cut and Importance of Lumber Industry.

From year to year, as the amount of standing timber is reduced, the annual cut is being lessened. This reduction is slowly but surely wiping out the most important industry in these northern counties. The material welfare of many communities in this region has already suffered from the loss of wood-working industries, and as the forest is further depleted, others must likewise suffer. The present importance of this industry in the ten counties is shown by the 750,000,000 board feet of lumber cut during the year 1908. In addition to this, a large amount of timber was cut in these counties for transportation to mills outside. For instance the mills in Marathon county, where more than 143,000,000 feet were sawn in 1908, depend in a large measure on the more northern counties for their timber supply.

If this important industry is to be even partially perpetuated it will be necessary in some way to encourage the growing of new

forests, and a reform in the method of taxing forest land should play an important part in making it profitable for private owners to take up the work of reforesting their cut-over lands.

Examples of Actual Taxation.

The following are a few typical examples from a large number of cases, comparing the assessed value with the actual value.

On one forty in one of the northernmost counties an estimate of the timber shows 765,000 board feet of white pine and 85,000 board feet of red pine, with a little scattering of hardwoods, mostly birch and maple. The value of the timber is easily $6,715, and the value of the land is placed at a little less than $4 per acre, or $150 for the forty, making a total estimated value of $6,865. The assessed value in 1909 was placed at $3,450, or practically 50 per cent of the true value. The tax rate in this case was .0246.

On another forty the estimated stand of timber is 810,000 board feet of white pine and 90,000 board feet of red pine, with practically no hardwoods in mixture. The stumpage value of the timber is conservatively placed at $7,110 and the value of the land at $150, making an estimated true value for the forty of $7,260. The assessed value in 1909 was $1,200 or 16 per cent of the true value. The tax rate in this case was .0242.

A very large number of forties in this county are assessed at a flat rate of $1,200, which makes a variation of from 16 to 60 per cent of the estimated true value of the forty.

The hardwood land is assessed at about the same ratio to its true value as the pine land. One forty, containing 100,000 board feet of hemlock, 10,000 board feet of basswood, and 160,000 board feet of birch, is estimated to be worth $800 for the timber alone. Adding $150 for the land gives a total value of $950. The assessed value in 1909 was $260 or 27 per cent of the estimated true value. The tax rate in this case was .0338.

One forty in another county has a stand of 540,000 board feet of white pine and 20,000 board feet of red pine. The timber itself is worth $6,680 and the land about $80, making a total value of $6,760. The forty was assessed at $2,418 in 1909 or about 36 per cent of its true value. The tax rate was .044.

Another forty contains 800,000 board feet of white pine which is worth $9,600. The land is worth about $2 per acre, making

a total of $9,680. The assessed value is $2,780 or 28.7 per cent, and the tax rate was .044.

A high assessment appears in another forty which has a stand of 110,000 board feet of white pine worth approximately $1,320. The timber and land together are worth $1,400 and were assessed in 1909 at $1,280, giving a ratio between assessed and true values of over 91 per cent, and the tax rate was .044.

A farm of 160 acres in the western part of the same county has 60 acres of cleared land. It is valued at about $35 per acre for cultivated land and $6 for unimproved land, which makes a total value of $2,700. The assessed value in 1909 was $840, or 31 per cent of the true value, and the tax rate was .044.

Much of the cut-over land in another county is assessed at $80 a forty or $2 per acre. As low assessments as $60 a forty or $1.50 an acre, are found. Such land as is assessed at this latter figure is usually swampy and of practically no value for forest growth when once cut over, owing to the difficulty of getting the land naturally restocked with trees. It is probable that the average value of cut-over land in this county does not exceed $2.50 an acre, and much of it is worth less. Therefore, an assessment of $80 a forty on cut-over land is practically at the ratio of 100 per cent of its true value. There are large areas of cut-over land also that are assessed as high as $200 a forty, and in some cases individual assessments are found even higher. Such assessments are often in excess of the true value of the land. Timbered forties in the county are more or less uniformly assessed at an even figure of $200, $300, $360, $380, $400, $440, or $500. Five hundred dollars is practically the highest assessment on timbered land in the county. In certain townships a flat figure of $260, $340, or $400 a forty will be used for several sections of land.

Assessment of Timber Lands.

The following table illustrates how the taxes on timberland have increased during the past few years. The figures are taken for a number of forties in one of the northern counties. It is seen that a large percentage of increase in tax occurred each year during this period, 1904–1909, with the exception of the last, when a decrease of 77 per cent of the tax of 1908 took place. The increase during each preceding year is explained by

several causes. Probably the increase in the actual value of the holdings through the rise in stumpage is of considerable importance, for assessors are usually quick to raise assessments wherever it is justified. Another factor, which often accounts for increased taxes, is the growth and improvements within the towns, which means greater expenditures and larger taxes to meet them.

These factors operate on all classes of property alike. In the case of timber tracts, however, there has been a growing alarm that, with their depletion, the towns would be deprived of their largest source of revenue. There is everywhere, therefore, a growing tendency to obtain as much revenue as possible from the timber before it is entirely removed. As a result of this policy the timber holder is being forced to stand a constantly heavier share of the community's tax burden and to furnish improvements for the future's needs. Present taxes are thus being used frequently to provide for permanent improvements, the use of which will come mainly in the years to come. The local governments are usually convinced that timber is not taxed as high as it deserves, and, therefore, to provide against a future when there will be no timber to tax, they do not hesitate to raise gradually the tax on timberland.

It certainly can not be denied that there are extensive timber holdings that are or long have been underassessed, and this is especially liable to be the case where the politics of a town have been controlled by the lumber companies operating within it and where, therefore, the assessments are made by the companies themselves. Rapid rises in taxes are very often attributable to the change from such a situation to one where the town gains control of its own politics. This is the case in many towns in Wisconsin which have freed themselves from the control of lumber companies.

Some of the largest drops in taxes noted in the last column are probably due to the removal of the timber on the forty before the end of the 1908 tax year.

Actual Value 1909.	Amount of Taxes Paid per Forty Acres for Years.					
	1904.	1905.	1906.	1907.	1908.	1909.
$705.00	$3.71	$4.80	$11.25	$32.90	$33.06	$23.40
568.00	3.18	3.90	6.75	14.85	24.04	17.16
202.00	2.12	2.70	3.60	7.92	12.02	8.58
1,042.00	6.36	7.20	20.10	31.35	42.07	30.03
632.00	5.04	6.60	10.50	23.10	28.55	20.48
310.00	4.24	5.40	8.70	14.85	18.08	12.87
1,746.00	6.36	7.80	17.25	66.00	72.12	51.48
1,406.00	5.04	6.60	13.80	25.58	39.07	27.89
576.00	3.70	4.80	4.20	26.90	33.66	23.79
538.00	5.04	6.60	13.05	27.03	30.65	21.84
885.00	6.36	7.80	16.50	28.71	45.08	32.18
1,271.00	7.42	9.30	28.55	42.25	49.58	35.30
580.00	6.36	7.80	16.95	47.69	30.05	21.45
1,681.00	6.89	8.70	25.65	45.71	69.12	49.37
46.00	.80	.90	.75	.85	1.50	.98
995.00	6.36	7.80	21.00	36.47	30.05	21.45
1,086.00	6.36	7.80	21.00	50.86	48.08	34.32
1,308.00	6.36	7.80	21.00	52.97	54.09	38.61
790.00	6.36	7.80	21.00	49.67	48.08	34.32
520.00	6.36	7.80	21.00	37.80	30.05	21.45
848.00	7.69	9.60	9.45	21.45	33.06	23.60
1,088.00	6.36	8.10	21.00	49.50	42.07	32.03
1,592.00	6.36	7.80	15.75	39.60	60.10	42.90
1,850.00	6.36	7.80	21.00	94.88	84.14	7.20
1,526.00	6.36	7.80	21.00	47.36	69.12	7.20
1,639.00	6.36	7.80	21.00	47.03	69.12	7.20
1,502.00	6.36	7.80	21.00	43.73	61.60	7.20
1,437.00	6.36	7.80	21.00	39.77	51.09	36.47
1,113.00	6.36	7.80	21.00	46.70	57.10	40.76
1,054.00	6.36	7.80	21.00	43.07	52.59	37.64
317.00	6.36	7.80	13.95	31.35	30.05	7.20
950.00	4.24	5.40	15.15	27.72	42.07	8.10
891.00	6.36	7.80	15.75	21.29	32.45	23.40
1,573.00	6.36	7.80	15.75	45.54	69.12	49.44
781.00	6.36	7.80	15.75	27.89	35.46	25.35
834.00	6.36	7.80	15.75	16.34	25.54	18.33
1,003.00	6.36	7.80	15.75	25.58	37.83	27.30
843.00	4.51	5.70	14.10	23.10	33.96	24.18
624.00	4.24	5.40	9.45	24.59	32.75	23.40
80.00	1.06	1.50	2.25	7.43	1.50	.98
3,642.00	4.24	5.40	52.50	88.28	160.77	114.65
Total $42,129.00	$225.80	$280.50	$651.95	$1,455.69	$1,830.47	$1,0 1 49
Average 1,028.00	5.51	6.83	16.14	35.50	44.40	24.18

Methods of Assessing Timberlands.

Although the law very clearly states that "real property shall be valued by the assessor . . . at the full value which could ordinarily be obtained therefor at private sale," the assessment of timberlands in practically all of the northern counties is made in a most arbitrary manner and with apparent disregard of the requirement of the law just quoted. In only a few of the towns is there anything approaching true valuation in the assessment of this class of property. Timberland as a rule is not only greatly undervalued, but, moreover, the variableness of the ratios of assessed to true values in many towns presents striking examples of inequality in assessment. While in a few towns there has been apparently an attempt to follow a given percentage or fraction of the true value, a close inspection shows a pronounced variation from such percentage or fraction.

The fixing of low values is not considered a violation of the law. Each assessor is likely to take the general figures of his predecessor. He knows also that other assessors adopt a uniform value per acre for all farm and cut-over land and apply it throughout the assessment district, regardless of the land's advantage or disadvantage of location. The assessor is elected to office by the people whose property he is to assess. Then again he may be in the employ of one of the largest property owners in the town, and in passing it should be said that the administration of many of the towns is virtually in the control of the principal property owner therein, and that the assessor is in the employ of such owner while not engaged in the performance of his official duties. All of these conditions tend to encourage undervaluation, and it is believed they are in no small measure responsible for it.

The law also requires that in determining the value of real estate the assessor shall consider, as to each piece, the quantity of standing timber. For an assessor to get a fair approximation of the true value of such standing timber, he must be able to estimate with some degree of accuracy and be familiar with timber values. Many of the assessors do not have these qualifications, and those who do are often prevented from exercising them, except in a limited way, for the reason that the time allowed for making up the assessment roll is not sufficient to enable an assessor to cover as he should more than a part of his assessment district. It should be said, however, that in a few towns they do attempt to see each timber description in at least one or two townships each year. The assessor is accompanied by a lineman to assist in locating the description, and the assessed value is determined at that time. In a strict sense no cruised estimate is made. Such assessments are made each year on lands not previously viewed by the assessor until the entire town has been covered. In other towns there is very little evidence of such systematic work being carried on, although occasionally it will be found that an effort is being made in that direction.

Cut-over land is usually valued at a fixed rate throughout a town, varying only with a very rough classification of the soil as swamp, hardwood, or pine land. As a rule no attention is given to such important factors governing values as proximity to railroads, highways and water. Cut-over pine lands are sel-

dom assessed for more than $2 per acre, while cut-over hardwood lands will rarely exceed $6 per acre. In the extreme northern counties both cut-over pine and hardwood lands may be assessed as low as $1 per acre. Cultivated land in some towns is assessed at the same values as cut-over land. Even in the more developed farming communities the assessed value of cultivated lands seldom exceed $10 per acre, although the sale value in many cases is five times as great.

Instead of an actual examination of timbered land there is more often merely an interview with the owner. In most of the hardwood regions the land is not considered separately. However, when any estimate is made, the land and trees are treated separately. For example, in the one county where practically all the timber is estimated, a value of $2 per acre is always added to the assessed value of the timber. The county just referred to is the only one where it is known that cruises for estimating the timber for tax purposes have been made throughout the county. In some towns the cruised values of a considerable portion of the timbered area, are, of course, known to the assessor, who is either an officer or employe of one of the companies having extensive holdings in the town, but such cruised values are evidently not used in making up the assessment roll. In such cases the assessor uniformly keeps the assessed value as low as possible, not only on the company's holdings but also on all others. In adjoining towns, where the assessor is not so connected with a large owner, it will generally be found that assessed values are higher.

Assessments are lowered when the owner reports that the timber has been removed, and it is, therefore, classed as cut-over land and assessed at the prevailing rate for such land in the town where located. Generally, if not always, the assessor will accept such report as correct and make no investigation to determine whether or not the description has been entirely or only partly cut, with the result that if only partly cut, it is undervalued year after year. No doubt, in many instances descriptions are assessed without taking into account the standing timber thereon. At least a comparison of the assessed and estimated true value of many of the examples given herein would indicate that this is the case. So far as could be learned none of the assessors give any consideration to young growth in fixing values.

While the practice of undervaluation prevails throughout most

of that part of the state now being considered, it should not be understood that this condition is universal. In many localities a conscientious and fairly systematic effort is being made by assessing officers to conform to the law. In a large measure the importunities of the county supervisor of assessment have influenced the assessor in raising the valuation of this class of property; and in many cases, independent of such solicitations from supervisors of assessment, the assessor has endeavored to faithfully comply with the tax laws regarding valuation.

The Attitude Toward Fire.

One of the most serious obstacles to the practice of forestry by the lumber companies, and therefore, to the satisfactory working out of any tax system designed to encourage timber growing is the absolute lack of popular appreciation of the damage wrought to a forest by fire and the callous disregard on the part of many settlers for the state's fire laws. As a result the fire damage throughout this whole region is simply enormous, and the injury to young growth, which is usually not considered, is almost irreparable. A representative of one of the large lumber companies in Price county gave it as his opinion that in this county alone at least 20,000,000 board feet of lumber were annually ruined by fire. According to Mr. E. M. Griffith, State Forester of Wisconsin, the damage to mature timber and property from forest fires in 1908 amounted to fully $9,000,000. Consequently a most adverse feature of this fire situation is that no individual or company can consider forestry methods or hope to obtain reproduction on cut-over land until some adequate system of fire control has been tried and its efficiency amply demonstrated. Very little successs along this line can be expected until the state is willing to provide for a thorough fire patrol during all dangerously dry seasons. As clearly pointed out in the report of the State Forester of Wisconsin for 1908, the present system of fire wardens, while good as far as it goes, falls far short of meeting the actual needs of the situation. Under this system the fire wardens are all local men, and it is not strange that in a great many instances they should fail to take legal action against a neighbor who may have been guilty of breaking the fire law. But the most serious defect in the present law is its failure to provide for fire patrol, which is the one great need of this whole

region. The lumbermen so fully appreciate the urgency for such measures for prevention of fires that they are willing in many cases to form a fire protective association to be maintained by levying an annual assessment on an acreage basis from each member, and having as its primary object an extensive system of fire patrol. Such a patrol should not cost over 2 cents per acre per year, and could be placed directly under the State Fire Warden, by whom the individual local patrols could be appointed and made regular fire wardens. A patrol system of this kind should extend to the other parts of the towns as well as to the holdings of the associated lumber companies, and the towns should be charged for patrol and fire-fighting service within their borders. At present it is left entirely to the discretion of the towns as to how much they shall pay for such services, whereas they should be compelled to settle all accounts for fire fighting or patrol submitted by the wardens and audited and approved by the State Fire Warden.

Another variation of this same plan may be suggested whereby the present town fire warden system should be maintained independently of the lumber companies' patrol, but working in harmony with it under cooperative agreement between the state and the association. In any case it is quite obvious that very limited results can be looked for from tax reform until the fire risk is largely eliminated through adequate legislation and effective enforcement of the same.

Conclusions.

As is clearly brought out in the preceding tables, the present method of assessing forest lands is ridiculously uneven and in many cases unfair to the timberland owner. That it is not unfair to the timberland owner in every case is no fault of the present law, but is due to the lax administration of the law by the assessors. While considerable cut-over land has been abandoned in the past on account of taxes, little or none is now being so abandoned. The reason for this is not decrease in taxes, because, as has been shown, taxes have increased, but the increased or expectation value of the land itself for agriculture. While forests have in some cases been overtaxed, leading in a few cases to hastening the cut, taxation has not in the past greatly influenced logging operations in Wisconsin. But the fact that it has had little

influence in the past does not mean that it will not have more in the future. The great increase in assessments on forest land in the last few years, coupled with the fact that assessments are still increasing and, more than this, with the fact that under the present tax law they can still increase, makes it inadvisable at present for a private owner to practice forestry on his lands. In such a long-term investment as forestry a private owner must know definitely what the annual charges against his business will be. Under the present system he has no means of knowing how great his taxes will be in 10, 15, or 20 years. In an investment covering such a long period as this, 50 or more years, where fire risk also has to be considered, it is important to know exactly what taxes will have to be paid. Probably nothing discourages investments more than uncertainty as to future costs. And whatever can be said of the present system of taxation, there can be no question of its arbitrariness and uncertainty. If there is added to risks from fire, from insects, from fluctuation in lumber values, and other hazards of forestry, a further uncertainty as to what the taxes are going to be, private owners can not be blamed for some hesitation in starting on an investment that may have to pay taxes for 50 or more years before returns can be realized. And the timberland owner cannot safely figure on the continuance of the present lenient administration of the property tax. As has been shown in this report, the tendency is toward a stricter enforcement of the law, and consequently higher assessments.

The possibility of the practice of forestry by private owners depends on two things—an equitable system of forest taxation and protection from forest fires.

Admitting that the evidence gathered in connection with this study shows that, on the whole, owners are not now excessively burdened by the taxes on their standing timber, it does not necessarily follow that the present method of taxing this class of property is satisfactory. We have seen that in the actual administration of the law every rule of equality and uniformity has been violated, and that precision and certainty have been displaced by arbitrariness and uncertainty. Under these conditions owners can not manage their timber in accordance with approved methods of forestry with a view to holding for a second cut, for there would not be even a semblance of certainty as to what the tax burden of future years would be. On the other hand, if the pres-

ent tax laws were strictly enforced, thereby enabling an owner to determine with a fair approach to certainty the probable amount of taxes he would have to pay in future years, the burden would appear to be so prohibitive that no prudent man would attempt as an investment to protect and care for the young growth with a view to obtaining a second or future cut.

In the past, probably the one thing that has prevented a more wasteful cutting than has actually taken place, and that has saved much of the remaining timber, is the fact that the lax enforcement of the tax laws has kept the burden on timber at a minimum.

The evidence presented in this report has demonstrated that with respect to timbered land the general property tax is administratively unworkable. The problem of forest taxation can never be satisfactorily worked out under it because the system is fundamentally wrong. It is believed that nothing short of a complete readjustment of the present method of taxing this class of property will make possible an equitable solution. Growing timber is so essentially different from the great mass of real property that it deserves different treatment in the matter of taxation. Especially is this true if the state desires to encourage the perpetuation of forest growth and the practice of forestry on privately owned lands. If possible the adjustment should be so made as to promote an adherence to the essential principles of modern forestry among timber owners, and the care and protection by them of young growth both before and after the removal of the mature timber in order that the land might be held for a second or future cut without making it necessary to resort to artificial planting.

It should be said, however, that it is not believed an adjustment of the tax laws, no matter how perfectly worked out and administered, will alone bring about the practice of forestry, except in a limited way, or the extensive growing of timber as an investment, on privately-owned lands. Taxation is only one of the several important factors that at present make the growing of timber commercially unprofitable and consequently unattractive to investors or those engaged in the timber business. The fire hazard, the length of time before returns on the investment commence to come in, stumpage values, and many other less important considerations are factors which many regard equally as deterrent as taxes. While this may be true today, it may not be true to-morrow. The menace from fire is admittedly great, but

the time must and surely will come when it will be reduced to a minimum by the inauguration of more effective measures of prevention and control than now exist. It is to be hoped that the ever-recurring destruction of forest growth from fire will bring about the strictest possible enforcement of the fire laws now on the statute books, and if they are found to be inadequate, then the enactment and enforcement of laws that will reach and remedy this devastating evil. Undoubtedly much can also be done along educational lines toward correcting this evil. With few exceptions all forest fires originate from some agency within human control, and it is therefore reasonable to believe that those exercising such control can by thorough and systematic instruction be trained to exercise the utmost caution in building and caring for fires that by chance are likely to spread to neighboring timber.

The long period that must elapse before there is any substantial return on the investment is, of course, a discouraging feature. Whether it will greatly retard the commercial growing of timber, if all other conditions are favorable, can only be conjectured. Undoubtedly the increase in stumpage values that occurs as the timber supply is gradually diminished will do much to make the proposition more attractive as an investment than it appears to be to-day.

While the introduction of a more equitable system of taxing growing timber may not in itself be a sufficient inducement to cause private owners to engage extensively in the growing of timber commercially, it would undoubtedly be a step in the right direction. That such an innovation would help immensely to stimulate this sort of enterprise and make it much more profitable and attractive than it is at present can not be gainsaid. The change must come sooner or later if the state is to attempt to remedy existing conditions, and there is no apparent reason why decisive action with that end in view should not be taken now. The remedy can not, of course, affect the past or to any great extent the present, but must necessarily be confined to the future. Its aim should be to encourage the growing and proper management of new forests. And although a change for the better in existing conditions may do much to promote the growing of a future timber supply by private capital, it is firmly believed that if the supply is to be commensurate with the local needs, the greatest part of the burden in providing it must and will rest with the state.

In the northern counties there is a great area of essentially forest soil, land that will probably never be susceptible to any use other than the growing of timber. In order to encourage the owners of such land to hold it as a forest property and to apply practical forestry to its management, the enactment of legislation that will include the following provisions is recommended:

1. That any land in the state suitable for timber growing and occupied by a natural or planted growth of trees, or both combined, may be separately classified for taxation, and that when so classified the land and the wood and timber thereon shall be taxed in accordance with the plan set forth in paragraphs 5 and 6.

2. That the determination of the question as to whether or not any land is suitable for timber growing shall rest with the State Board of Forestry.

3. That all applications to have land so classified shall be made to the State Board of Forestry, in manner and form to be prescribed by it, and shall be acompanied by a description and plat of the land and such other information as said Board may require.

4. That if the decision of the State Board of Forestry is in the affirmative, it shall submit to the owner a plan for the future management of the land and trees, and shall certify to the State Tax commission that the land has been separately classified for taxation in accordance with the provisions of the act.

5. That when so classified the land shall be separately taxed annually; that in making the assessment the land shall not be valued at more than $1 per acre; and that in fixing the valuation the assessor shall in no case take into account the value of the growing timber.

6. That whenever any timber or wood is cut from such land the owner shall be required to pay an amount equal to 10 per cent of the gross value on the stump of the wood and timber so cut.

7. That the owner be required before the timber is removed from the land to file with the State Tax commission, a true and accurate return under oath or affirmation of the variety and gross amount and value of all material that has been cut.

8. That the assessment and collection of such tax on the timber shall be in the absolute control of the state, leaving the tax on the land where it is now.

9. That the management of lands so classified under the act shall be subject to such supervision as the State Board of For-

estry may deem necessary to protect the public interest and to insure the proper management of such land and timber.

10. That failure on the part of the owner to comply with any provision of the act or to carry out any instructions of the State Board of Forestry shall be sufficient cause to cancel the certificate classifying the lands for taxation.

11. That where a certificate separately classifying land is canceled for either of the causes mentioned in the preceding paragraph, the owner of the land covered by such canceled certificate shall be required to pay an amount equal to what the total taxes under the general property tax would have been for the period of time the land was so separately classified.

12. That when there is reason to believe that a return is incorrect or where the owner has failed to make a return, the State Tax commission may require from the owner such further information as may be deemed necessary; and for the purpose of ascertaining the correctness of such return or for the purpose of making a return where none such has been made by the owner, the State Tax commission shall be authorized to designate an agent to examine any books or papers bearing upon the matter and to determine the actual amount and gross stumpage value of the timber cut, which determination shall be the basis for fixing the amount of taxes the owner shall pay.

Conditions in Wisconsin indicate that a tax on the yield, together with a nominal annual tax on the land, is superior to any of the various tax laws that have from time to time been proposed. It would be far more equitable, however, if no annual tax were levied on the land, or if levied, to allow the aggregate amount of such taxes, together with interest, to be deducted from the tax on the yield when it is levied. But if such tax were not collected annually, it is probable that the local revenues might be so reduced as to seriously interfere with the fiscal affairs of the community. It is not recommended that the annual tax with interest be deducted from the yield tax at the time it is levied, because it would be simpler, administratively, to offset such annual tax by reducing the rate of the yield tax.

The maximum value at which land shall be assessed is fixed at $1 per acre. In many of the towns cut-over lands are now assessed at that rate. However, in others the rate is much higher, and for that reason it may be preferable to increase the maximum value to $2 per acre. The self-assessment feature of the

proposed law is made with a view to lessening the cost of administration. It would be far more desirable for the state authorities to check in every instance the return of the owner for the purpose of verifying the amount and value of the material cut, and it is recommended that this be done if the cost of such verification is not prohibitive.

If the foregoing plan for assessing woodlots and private forests is adopted, some provision should be made for returning all or a part of the revenues collected by the state authorities to the counties and towns entitled thereto.

What the State Should Do.

Even though a satisfactory adjustment is made of the tax laws so far as they relate to timber, it is none too certain that it would result in promoting the growth of timber by private capital on a very extensive scale. Certainly such remedial legislation can not be expected to assure the future generation of a sufficient timber supply. While a consideration of state forest reserves may be somewhat aside from the subject of forest taxation, it nevertheless deserves mention here because it is believed that only through direct state action can there be a reasonable assurance of a sufficient supply of timber in the future. The state has already made a splendid start in the establishment of forest reserves, and it is to be hoped their extension will be rapidly carried forward. There are extensive tracts of land in the northern part of the state that are essentially forest lands, and it is feared that unless the state takes up the work of reforesting them they will continue as they are now, unproductive wastes.

Of the various plans that might be adopted for the acquirement of these lands by the state, the simplest, least expensive, and most effective method will be for the state to purchase them in the open market. The present plan for raising money with which to purchase forest reserve land, although an excellent one, has its limitations. It will hardly furnish all the funds that will be needed if the state is to do all that it can and should do in reclaiming these lands from their present idleness. By all means the state should immediately provide by appropriation such additional funds as may be needed in carrying forward this important work. Not only should waste and cut-over lands be purchased, but also lands chiefly valuable for the growing of timber

that contain a growth of young or partly mature trees. The purchase of restocked lands would make it possible for the state forest reserves to be revenue producers practically from the beginning.

The perpetuation of a timber supply in the state is so fundamentally important to the general welfare of the people as to make it necessary for the state to at once take affirmative action along the lines suggested, and not rely to any great extent upon private enterprise. At present the great tracts of land in the northern part of the state that are now unproductive, but that should be under forest cover, can be purchased by the state at a comparatively low figure. The longer they remain in their present condition, the more difficult it will be to make them productive as a forest property because the fires that are continually running over them are gradually but surely so impoverishing the soil as to make them eventually valueless for any purpose.

A SOIL SURVEY OF A PORTION OF THE FOREST RESERVE.

During the summer of 1910 at the request of the State Board of Forestry the College of Agriculture of the University of Wisconsin made a careful soil survey of seven townships within the forest reserve area in Oneida and Vilas counties. The area covered included all of towns 38, 39 and 40, range 7 E. and portions of town 43, ranges 5, 6, 7 and 8 E., as it was thought that these townships were fairly typical and representative of the forest reserve area in these counties. Mr. O. P. Bergh had charge of this work under the direction of Professor A. R. Whitson of the College of Agriculture.

The main object of the survey was to determine definitely by means of a careful field examination by soil experts whether the land within these townships was upon the whole suitable for agriculture or whether it should remain as forest land and be included within the reserves.

It was known before the survey that a certain percentage of fairly good agricultural land would be found but the point to be determined was the exact percentage of such land, its total acreage and where located so that it could be determined whether the State Board of Forestry would be justified in inducing settlers to locate upon the land, or if the whole area should be held under forests.

It was found in the survey that it was practicable to distinguish four types of soil in this region. The first is a loamy sand of rolling topography; the second, sand to sandy loam with a rough topography and usually stony; the third, jack pine plain sand; and the fourth, marsh or swamp land. This classification seemed to be the one that would be of the most value under the circumstances, inasmuch as it would distinguish between those areas that might be of considerable value for agricultural use and those that would have relatively little value for such a purpose. The results of the survey give the following approximate percentages for the four types:

1. Loamy sand (possible agricultural land),.....22%
2. Sand to sandy loam (forest land),.....72%
3. Jack pine plain sand (poor agricultural land),.. 4%
4. Marsh or swamp land (forest land),..... 2%

Type 1. This loamy sand soil, which is classed as possible agricultural land, comprising about 22% of the total area, has a gravelly subsoil but is comparatively free from surface rock, and is adapted to truck crops, such as potatoes, and many garden vegetables. Grain crops would do fairly well, and possibly clover and alfalfa might be grown. On the whole, the areas of this type so far as the soil is concerned, are of moderately high agricultural value.

Type 2. This comprises 72% of the total area and the soil varies from sand to sandy loam. The topography is so rough and broken that the land is unsuitable for farming purposes. Much of the land is also very stony and the few settlers who have located upon this type of land are having very little success in their efforts to till the soil.

Type 3. This includes all the jack pine plain sands which comprise about 4% of the total and are classed as poor agricultural lands. The topography is level to gently rolling and the soil, which is a coarse sand, is free from stones, while the subsoil is composed of stratified sand or gravel. It is typical sweet fern and jack pine land.

One settler was attempting to farm this type of soil and the fairly good appearance of his crops, in spite of the dry season, indicates what might be hoped for on this type generally, at least during the first few years after clearing off the timber, though it is highly probable that after a few years of further cropping, its fertility will, to a large extent, be exhausted.

Potatoes, hardy vegetables, early corn and some other crops may be grown, although the very light character and looseness of the soil will make it necessary to use green manuring and other means of adding organic matter, and at best it can be considered of only moderate value for agricultural use.

Type 4. This is marsh or swamp land which forms comparatively small areas along the lakes, and is also found scattered through the other types of soil, and comprises about 2% of the total area. Many of these marshes are now covered with a good stand of tamarack and black spruce, but in time it may be found advisable to drain some of them for agricultural purposes.

Summing up the four types we find that types 2, 3 and 4 aggregate 78% of the total area and are true forest land upon which the state should not encourage settlement. As stated it may in time appear advisable to drain some of the swamp land, but this

type constitutes only 2%, and no drainage should be undertaken in this region until a careful examination has been made to determine if possibly these swamps are not of more value as natural reservoirs, as they absorb an enormous amount of rain and snow water, giving it off very gradually during the dry summer months and thus aid materially in maintaining a uniform stream flow.

Type 1, or loamy sands, comprising 22%, are the only areas that at present should be considered as even possible agricultural land. Such soil has a relatively small amount of organic matter and there is reason to believe that a chemical analysis would show it to be exceptionally low in its content of mineral elements.

As pointed out in this report, there are over 13,000,000 acres of land in northern Wisconsin awaiting development and much of it is the highest grade agricultural soil. There is therefore no excuse for encouraging settlers to locate upon lands where the best type holds out only a fighting chance for meager success. If settlers should locate upon the 22% of possible, but poor, agricultural land they would be doomed to comparative isolation, and would be deprived of good schools and the many advantages of a growing community.

Wisconsin is so rich in her wealth of undeveloped agricultural lands and the state has so much at stake in the prosperity and happiness of the settlers, that the state should direct such settlement into the proper channels. The settler who locates upon non-agricultural land and finds after years of hard work that he can make only a bare living naturally becomes very much discouraged and almost hopeless. He and his whole family soon begin to degenerate and are a curse to themselves, their community and the state. Such conditions are only too common in many of the sterile sections in the older states, but there is no reason for their occurring in Wisconsin and they should not be allowed to.

The soil survey of these seven townships in Oneida and Vilas counties proves that they should be permanently held within the forest reserve area. The forest rangers and their families will use a considerable portion of the areas that are possible agricultural land, but the state should not encourage any settlers to locate in this region.

URGENT NECESSITY FOR COMPLETING THE SOIL SURVEY.

The best available estimates show that there is approximately 13,000,000 acres of unimproved land in the twenty-two northern counties. Most of this land has a good soil, is free from rocks and is well adapted to farming, so that eventually probably 10,000,000 acres will be used in some form of agriculture, leaving some 3,000,000 acres for forest growth.

It should be understood that these figures are mere estimates, based upon the best available figures, but they are probably approximately correct in the proportion of agricultural to non-agricultural land and give some idea of the situation.

It need not be feared that the State Board of Forestry will try to class agricultural as forest land, for it is one of the main tenets of forestry that timber should not be held upon land suited to agriculture, as there is enough land in every country which is suited only to forest growth. However, although foresters receive some training in soil analysis, they are not experts and should not attempt to finally classify lands, where the question is a close one to decide, as it is in so many sections of northern Wisconsin.

The legislature of 1909 appropriated $10,000 a year, for two years, for a soil survey and the government put in an equal amount, so that $20,000 a year has been available for this work in 1909 and 1910. The work is being done under the direction of the College of Agriculture of the University and the State Geological Survey, and the field force examines each forty of land and maps the exact character of the soil.

During the summer, at the request of the State Board of Forestry, one field party was sent to examine some typical townships in Oneida and Vilas counties, within the forest reserve area, and the results of their work will be found in the preceding chapter.

In some townships, out of the total of 23,040 acres, perhaps from 1800 to 2000 acres would be found that was classed as poor agricultural land. It was just over the border line from being

classed as true forest soil and the question arose as to whether the state should sell say 2000 acres to settlers when the balance of 21,000 acres in the township should be permanently held under forests. The answer should be unquestionably No, for if settlers were encouraged or allowed to locate on such a small tract surrounded by lands to be held under forests, they would soon feel the lack of schools for their children and of the comforts and society of a well settled community.

When the government created the first forest reserves in the West, the few settlers living in these reserves complained that they were cut off from neighbors, good schools, etc., and Congress, feeling that their complaint was a just one, passed a law allowing any settler within a forest reserve to relinquish his claim to the government and select an equal acreage of government land anywhere outside of a reserve. This is merely mentioned to show that the government soon found that homesteaders were not content to live on isolated tracts and thus to be deprived of many of the benefits and advantages of communities, and if Wisconsin should allow settlers to locate on small and remote tracts within the forest reserve area, it would be doing a great injustice to the settler and storing up trouble for the state.

It will readily be seen therefore that it is very important to secure an accurate and complete soil survey of the proposed permanent forest reserve area, just as soon as possible, so that it can be definitely known just which townships should be included within the reserves and which excluded. Fortunately very few settlers are located in this area and not one acre of state land should be sold until the survey is completed.

The immediate need of a survey as far as the forestry work is concerned is in the forest reserves, but as has been stated, lumber and land companies and individual owners will not protect the young growth upon their lands until they know whether it is suitable for agriculture. Once they are certain it is valuable only for the growth of trees, they will either protect it themselves or sell it to some company or individual that will. It would seem that all roads lead to a soil survey, for in many parts of the state the protection of the forests is neglected on account of the feeling that possibly all of the land is valuable for farms, and while this doubt blocks forestry progress, the fires continue to destroy our forest wealth. The legislature should make generous appropriations for the soil survey, for every year's delay in its completion means a heavy loss.

THE FOREST PRODUCTS LABORATORY AND ITS WORK.

The great conservation movement, in so far as it relates to forestry, has been attacked by some who claim that we of the present generation are spending too much of our own money and emphasize too strongly the welfare of future generations, and are neglecting the problems of today which each and every one of us must face.

This criticism has been due largely to a common belief that forestry consists solely in growing trees, and that we are spending large amounts of money in reforesting areas which will not produce trees of any practical value for many years. There is, however, a very practical and important way in which future generations can be taken care of, and at the same time we can benefit ourselves. This consists in our utilizing to better advantage the timber that we now have. Anyone who is at all familiar with lumbering operations knows the enormous waste with which they are conducted. Experts have figured that this amounts to about 50 per cent. In other words, we waste about 50 per cent of what we grow. Most of our large sawmills have huge burners in which they burn up a large amount of wood for which at present no means of utilization is known.

In order to demonstrate the utilization of mill waste and show how allied matters can be more efficiently handled, the United States Forest Service has organied a branch of forestry the activities of which consist solely in working on the problems of today. Last June this branch of the Forest Service dedicated the Forest Products Laboratory at Madison, Wisconsin, which laboratory is the largest of its kind in the world. The building is owned by the University of Wisconsin, and the university is also supplying the laboratory with the necessary heat and power in order to run the various machines. The Forest Service on its part maintains a corps of workers comprising about sixty people, and furnishes all the apparatus and material necessary for the various tests. The machinery already installed has cost over

$50,000, and is the best obtainable. In addition, the Forest experts give a course of lectures to the students of the university, describing in detail the properties of various American woods, how they can be identified, and methods by which they are utilized. Although this course only began this fall about thirty-eight students are already enrolled.

As the field of work investigated by this laboratory is exceedingly broad, comprising as it does all phases of the manufacture of wood products, it has been necessary for reasons of efficiency and economy to divide it into seven groups called sections, and to place in charge of each a man who is thoroughly familiar with the work of that section. The investigations covered by these various sections can be considered briefly as follows:.

Timber Tests.

This section investigates the strength of various woods and determines their mechanical properties, which facts are in such great demand by architects and engineers. It is now working on the strength values of many hardwoods which grow in Wisconsin. These were donated for testing purposes by the Northern Hemlock & Hardwood Manufacturers' association. As an illustration of the work of this section, the investigations on hickory might be cited. Manufacturers have always had a decided prejudice against what is known as red hickory, claiming that it could not be utilized in high grade work for spokes, pick handles, etc. This section undertook to determine what difference there is in the strength of red and white hickory and found that for all practical purposes it is negligible. As a result, instead of throwing away the red hickory as was done heretofore, manufacturers are beginning to use it in the manufacture of spokes and other commodities, thereby economizing greatly in our consumption of white hickory.

Considerable trouble has been experienced by certain lumber companies in that their boards have stained a bluish color while seasoning, this stain depreciating their value. It has been found that dipping the boards in soda solutions retards such staining, but some consumers have objected to using the soda-dipped lumber, claiming that it was not as strong as the untreated wood. Tests are now under way to determine whether or not this claim is founded upon fact.

These examples serve to illustrate the work being done by the section of timber tests.

Timber Physics.

Very little is known of how our American woods look under the microscope, and the section of timber physics is now preparing a complete set of photographs showing the microscopic structure of American woods. It is also collecting samples of all the important American timbers, which samples are being arranged in the form of an exhibit so that their various appearances can be easily determined.

A considerable loss in lumbering is due to the fact that we do not at present know how to dry certain kinds of wood without having them warp out of shape or check, and investigations are under way in the section of timber physics to find ways and means whereby certain of our American woods can be kiln dried to better advantage.

Distillation.

Quite an area in Wisconsin consists of stump land, and the section of distillation is finding out among other things, just how much turpentine can be extracted or distilled from such stumps, and also the quality of the product. If these stumps can be utilized to advantage, it will greatly assist the agricultural classes in clearing their stump land at a profit.

Investigations are also being conducted to show the quality and quantity of turpentine that can be obtained by chipping wood into different sizes and using different steam pressures.

Paper Tests.

The paper industry in Wisconsin has a very large amount of capital invested in it. All who are familiar with the state know that the supply of spruce has become practically exhausted and many of the large paper mills, employing a great number of people, are being forced to import spruce from other states. This naturally places them under a decided disadvantage when it comes to competing with other establishments more favorably located with regard to their supply of wood.

The pulp section is cooperating with the American Paper and Pulp association in trying to find how common woods that are at

present unused, such as jack pine, can be utilized in place of the more expensive and scarcer spruce wood. This work is of such great and immediate importance that a branch laboratory has been established at Wausau, Wis., the primary object of which is to determine the quality and quantity of pulp that can be made from inferior woods growing in the state, by what is known as the mechanical process. If inferior woods like jack pine can be used in the manufacture of paper, the greater permanency of Wisconsin's pulp mills will be assured.

In addition to the investigations into the manufacture of pulp by mechanical means, tests are also being made in the laboratory at Madison to determine the quality of paper made by what are known as the chemical processes which use soda and sulphite as a means of disintegrating the wood.

CHEMISTRY.

Naturally there are a great many chemical problems connected with the work of an institution such as the Forest Products Laboratory, and in order to solve them an up-to-date chemical laboratory has been installed. This section analyzes the quality of various turpentines, determines the quantity and quality of tannin extracted from different barks and woods, and the properties of chemicals used in the treatment of wood products.

PRESERVATION.

All are familiar with the way wood rots when exposed to the weather. The loss from this cause is enormous. For example, we use about 120 million cross ties every year in the United States. By giving them a proper treatment with chemicals it is possible to reduce our annual consumption of cross ties to 50 millions. The section of preservation therefore is attempting to find out the best means of prolonging the life of different kinds of wood. Experiments are under way to determine the possibility of utilizing cheap woods like hemlock in place of cypress in the construction of silos. Treated hemlock and pine are now undergoing tests in a silo belonging to the University of Wisconsin.

In addition, experiments are being made to determine what length of life can be obtained in fence posts cut from such timbers as jack pine, cottonwood, etc. Next year experimental street

pavements will be laid with blocks made of jack pine to determine their value for street paving purposes as compared with the more expensive woods such as longleaf pine.

The Chicago, Milwaukee & St. Paul railroad is aiding the laboratory in its determinations of the value of different woods not now used for cross ties, and ties made from jack pine are being treated and placed in the tracks of this company and records kept upon them. If it can be shown that these cheap and abundant woods, growing in Wisconsin, can be used to advantage when given a chemical treatment, it will greatly add to the permanency of a number of its present industries.

ENGINEERING.

As much of the equipment used in the investigations described above, is of original design and manufacture, a section of engineering has been created to do this work. This section is working upon designs for different types of wood preserving plants, and of apparatus for distilling turpentine, etc., the object being to make just as practical as possible the various discoveries that are brought out from time to time.

* * *

This sketch reveals, in brief, how the Forest Products Laboratory is working on problems that are bound to be of considerable practical importance to the Commonwealth of Wisconsin; but in addition, it is carrying on a large number of investigations that affect the United States as a whole. Any American citizen has a right to ask this laboratory for technical information relating to its work, and this information is given without any charge whatever. Moreover, the laboratory is always open for inspection, and those interested will be afforded a good opportunity to examine into its work just as closely as they may desire.

THE INTIMATE RELATION OF FOREST COVER TO STREAM FLOW.

One of the most valuable of Wisconsin's resources is her water powers. As the state has no deposits of coal, the great source of energy for manufactures, for transportation, for light and heat is in the many water powers that are well distributed over the state. It is of the greatest importance to the industrial interests of Wisconsin that these water powers be developed and utilized to their highest capacity and protected by the construction of reservoirs and the maintenance of a forest cover on all watersheds.

A uniform stream flow is of the utmost importance to the proper utilization of water powers, as the usefulness of a power must be measured largely by its head at low water flow.

It has been a common experience in Wisconsin for many years past, following upon the large lumbering operations in the state, that the thaws of spring have brought on more or less heavy floods and an enormous volume of water has been discharged through our stream channels within a comparatively short period of time and beside the inordinate waste of power and loss of water, a great deal of damage was done by erosion of the banks. By summer the same streams are reduced to a mere trickle and even our largest rivers but thinly cover their erosion-widened channels, while great clogging shoals of sand appear above the surface of the water. The great problem is to save the damaging flood waters of spring to supplement the summer flow.

A great deal can be accomplished by the operation of artificial reservoirs but the maintenance of a forest cover upon the upper watersheds is necessary, even with artificial reservoirs; and with an adequate area under forest cover, artificial reservoirs might be dispensed with.

Many people do not understand just how forests affect the regimen of streams. A comparison of conditions in the forest and in the open will make this clearer. In the spring the snow in the open is melted rapidly by the sun and wasted rapidly by the winds, and although much of the moisture is dissipated by evap-

oration, water is formed very rapidly by the melting snow and flows off all slopes without hindrance because the frozen ground has a hard impermeable surface. Even in summer there may be similar conditions in the open. The rain will flow quickly over the sunbaked ground, rushing into whatever natural channels are available, not finding permeable soil.

In the forest on the contrary, and especially in the pine forest, the snow is sheltered from the sun's rays and protected from the sweep of drying winds. It melts very slowly and gradually. In the cedar swamps the Indians find snow or ice for their sick far into the summer season. The water formed by the melting snow does not flow off over the surface. It is held by the thick layer of leaves and twigs that forms the forest floor and sinks gradually into the soil underneath, which is not only very permeable but contains an intricate network of rootlets and roots along which the water finds its way downward deep into the earth, whence it reappears long afterward through underground streams and springs, forming the small streams that feed our rivers. The summer rains also reach the forest soil gradually through the dense mid-season foliage, which drips water for hours after a rain, and are received into the soil, which yields them up gradually to the stream channels, as they are needed. In the open, the rains flow off rapidly over the ground surface and hard rains on bare ground beat the soil and wash it away, forming little gullies and then larger ones, and clogging the stream channels with detritus. The difference in the same soil in the open and under forest cover can be seen by examining an unsheltered road through a forest and the soil on either side. After a rain the road will be muddy but no matter how saturated the forest soil, it will be porous and grainy and one can walk over it without getting his shoes muddy.

Wisconsin has no mountains and therefore has no need to guard against sudden mountain torrents, with the accompanying loss of surface soil and the burying of fertile valleys under sand and gravel; but the configuration of the state is sufficiently varied to conduce to the production of floods and very serious ones, and the creation of innumerable reservoirs alone could never prevent certain serious evils. Much water might be stored and saved, but reservoirs could never prevent the sudden melting of snow on frozen ground, nor the washing away of soil and the clogging of both stream channels and reservoirs with sand and detritus.

The water that issues from forested watersheds and that flows

in forest streams, is remarkably clear. The forest soil is not only porous but it is bound together by the roots of trees and undergrowth and the water filters through it instead of beating upon it and carrying portions of it away. Of course the erosive power of water, charged with sand and gravel, is very much greater than that of clear water. The Mississippi river is a tragic example of the evils of deforestation and the United States government has recognized the source of the evil in granting to the forestry departments of both Minnesota and Wisconsin a tract of 20,000 acres, so as to bring the upper headwaters of the river under forest cover. No amount of dredging will make a permanent deep water channel. The planting of trees has held the banks intact on limited areas but with the varying flow, sands are continually shifting, channels widening and the level of the stream bed rising, while tons of soil are continually carried out through the mouth of the river.

Our water power resources are not only incalculably benefited by a uniform stream flow, but they become of little value with a widely fluctuating flow and all its accompanying evils, and although the operation of reservoirs will mitigate the evils, it will not cure them. The almost immediate and always disastrous effect upon stream flow when forests upon the headwaters of rivers are destroyed has long been recognized in all parts of the world where forestry is practised, but as this beneficial effect of the forest has been denied by certain interests in Wisconsin, the following authorities are quoted and a few examples of the many which might be given.

THEORY.

The theory of the relation of forest cover to stream flow and soil stability is as follows:

Gifford Pinchot says: "Both wide experience and scientific investigation have shown that there are two functions exercised by the forest in relation to stream flow.

"1. Its tendency to reduce the difference between high and low water, an influence which is of the utmost importance in the distribution of flood crests, and in maintaining a steady flow of water during the different seasons of the year and during cycles of dry and wet years.

"2. Its value as a surface protection against soil erosion, thus reducing the solid burden of storm waters, and decreasing the

deposits of sand and silt, which are the causes of shallow and changing channels.

"These two functions follow from the very nature of the forest as a soil cover. The roots of trees penetrate through the soil to the underlying rock, where they fix themselves in the crevices, and in this way hold in place the loose soil and prevent slipping and washing. The crowns of the trees break the force of the rain and also protect the soil from being carried away to the lower valleys during heavy storms. The leaves and the branches allow the rain to reach the ground but gradually; after a rain, water continues to drip from the crown for several hours, and the soil is thus enabled to absorb the greater part of it. Screened from the rays of the sun and covered with a surface mulch of fallen leaves and humus, the soil remains loose and granular in structure and is therefore capable of imbibing and retaining water with sponge like capacity. It is strewn with fallen leaves, branches and trunks, and traversed by a network of dead and live roots which impede the superficial run-off of water after heavy storms. This retardation of the superficial run-off allows more of it to sink into the ground through the many channels left in the soil by decayed roots. Surface run-off of rain water is wasteful and destructive, and unless artificially controlled serves as a rule no useful purpose and may inflict great loss. Sub-surface drainage makes the best use of the total precipitation that reaches the ground. It serves both for the sustenance of plant life and for the flow of streams. Accordingly the agency of the forest cover in increasing the seepage run-off at the expense of the surface run-off is the most important function which the forest performs in relation to the water supply.

"A common conception of the effect of forest destruction upon climate is that it reduces the amount of rainfall. Because springs become dry and streams shrink in a deforested region, it is assumed that less rain must fall. Whether or not there be any truth in this assumption (I believe there is), it is certain that the main cause of the observed facts is the profound effect which forest destruction has upon the course which the water takes after it reaches the ground. The greatest influence of the forest is not upon the amount of rain that falls, but on what becomes of the rain after it falls. The water that sinks into the ground passes for greatly varying distances beneath the surface before reappearing, and is thus drawn off gradually from the forested water-

shed and supplies the brooks with pure water relatively free from detritus."

B. E. Fernow in "Economics of Forestry" says:

"The philosophy of the influence on waterflow rests mainly upon the recognition that the rain and snow waters penetrate more readily a forest-covered soil than one that is bared of this protective cover. The action here is of a threefold nature; first, the mechanical obstruction which the foliage offers, reduces the amount of the water which reaches the soil and lengthens the time during which it can do so; the foliage, together with the loose litter of the forest floor, also reduces the compacting effect of the raindrops and the drying effect of sun and wind, and keeps the soil granular, so that the water can easily percolate, then the mechanical obstruction which the litter, underbrush, and trunks, and possibly here and there moss, offer to the rapid surface drainage of waters, lengthens the time during which this percolation may take place; and thirdly, the network of deeply penetrating roots, live and decayed, offers additional channels for a change of surface drainage into sub-drainage..... Particular interest in this connection attaches to the influence of forest cover on the melting of snow masses, which gives rise to spring floods. In the dense forest, the snow is usually less deep, a part being intercepted by the crowns of trees and evaporated, and lies more uniformly, owing to the absence of drifting winds. It is a well-noted experience that it will lie in the shade of the woods from one to two weeks longer, i. e. melt so much more slowly. These elements of distribution in space and time must have an influence upon the rapidity of surface flow, and if the soil is not frozen, time is given for percolation and gradual removal..... This forest effect on the run-off of terrestrial waters is naturally greatest and most important in mountainous regions, where the water has the tendency to collect quickly and to be carried off rapidly, but it also exists in the level plain, where it has the tendency to elevate the general ground-water level and thereby make a reserve available during times of drouth."

EXAMPLES.

The few following examples are given as showing the effect of forest cover on stream flow:

"Mr. W. B. Greeley of the U. S. Forest Service made a careful investigation of two streams in the Catskills. One, Esopus

creek, was well-timbered, having not more than 15 per cent of cleared land upon its basin. The Wallkill had 85 per cent of cleared land and the remaining forest cover was confined to small scattered woodlots, but its topography was such that there could be water storage by natural reservoirs. The differences in the two streams were as follows:—

"1. The slopes of the Esopus basins are twice as steep as those of the Wallkill.

"2. The fall of the Esopus is six times as rapid as that of the Wallkill.

"3. The topography of the Esopus basin is much more simple and direct than that of the Wallkill.

"4. The Esopus has no natural reservoirs, whereas a relatively large percentage of the Wallkill basin consists of swamps and ponds.

"The question was whether forest cover on the one hand or moderate topography, extensive natural reservoirs, and favorable geological conditions on the other, exert the greater relative influence in storing precipitation and equalizing stream discharge.

"It was found that the combined influence of the moderate topography, natural reservoirs, and favorable geological conditions of the Wallkill is somewhat stronger in promoting evenness of stream flow than the compact forest cover of the Esopus basin.

"At the same time the margin of difference between the regularity of the two streams is so small as to establish beyond doubt that the forest cover of the Esopus does exert a strong conserving and regulating influence upon the flow of that stream. This is especially true when we recall how unfavorable the other factors of topography and geology upon that catchment area are to equable stream flow. The forest cover of the Esopus thus appears to overcome to a large degree the unfavorable effects of steep topography, hard and dense surface rocks, and marked deficiency in natural storage facilities. It reduces the flow of that mountain stream to a regularity almost equal to that of a lowland type of stream where exactly opposite topography conditions prevail."

Mr. C. C. Vermeule in the report of the State Geologist for New Jersey for 1895 says:

"It is a matter of common observation that at such times rivers continue to flow when rainfall is very much less than the evap-

oration, and indeed, for long periods when there is no rainfall at all. Any thing which tends to increase this amount of water held in the ground, and to regulate its discharge into the streams, tends to give a larger flow, and to shorten the periods of very low water in the streams during droughts, and with this increased capacity of the ground to absorb rain comes also less frequent floods. The more water that is drained out from the soil the more can be absorbed when the heavy rains come at the end of the droughts. Humus in the forest forms a great sponge, and of itself holds a large amount of water, while it and the inequalities caused by tree roots, etc., tend to prevent the water flowing over the surface and the roots of the trees provide channels by which the water percolates into the sub-soil readily. In this way the forest will easily absorb a larger amount of water than open lands. A high state of cultivation also has a tendency to increase the capacity of the ground to absorb water because of constant loosening of the surface and the facilities provided for ready drainage. In this way cultivation, like forests, tends to render floods less frequent, but the effect of the drainage of the soil is that the ground water absorbed is fed out more rapidly to the streams during the early months of a dry period than is the case in forests; consequently, the ground water is sooner exhausted, and the duration of the low stages of the rivers during protracted droughts is thereby lengthened. Barren water-sheds offer much less capacity for absorption of rainfall. There is no humus or other matter on the surface to retain the rain, and the ground becomes hard and resists free percolation. The difference between forested and deforested water-sheds is very well illustrated by the Passaic and the Raritan respectively, while some of our small red sandstone water-sheds are good types of barren country.

"We have, in the following table, contrasted these types, the data being obtained from the Report on Water-Supply. This table shows in inches of rainfall the amount of water which would flow off to the several streams from their water-sheds for each month, during a drought of such a character that all conditions from rainfall, or depletions from evaporation, to the ground water are suspended, the water here shown being entirely water of drainage.

YIELD OF SPRINGS ON VARIOUS TYPES OF WATER-SHEDS DURING DROUGHT, IN INCHES OF RAINFALL.

Month.	Passaic Type of forest water-shed.	Raritan Type of highly-cultivated water-shed.	Type of barren water-shed.
First	1.16	1.43	.94
Second	.54	.64	.38
Third	.40	.45	.26
Fourth	.33	.35	.20
Fifth	.32	.30	.14
Sixth	.31	.27	.12
Seventh	.30	.25	.10
Eighth	.29	.23	.08
Ninth	.28	.22	.07
Total	3.93	4.14	2.29

"It will be observed that while the Raritan and the Passaic show nearly the same total amount of drainage, the Raritan gives up this water faster in the early months, and therefore its springs become sooner exhausted and it runs lower toward the last of the drought. The barren ground, having absorbed much less water, has less flow from springs throughout. How important this is upon the dry-season flow of these streams becomes apparent from the following table:

FLOW IN GALLONS DAILY PER SQUARE MILE DURING THE LAST EIGHT MONTHS OF THE DRIEST YEAR (1881).

	Passaic. Forested.	Raritan. Cultivated.	Barren water-sheds.
April	597,000	754,000	631,000
May	297,000	315,000	145,000
June	272,000	272,000	139,000
July	207,000	134,000	22,000
August	140,000	89,000	22,000
September	139,000	87,000	23,000
October	129,000	84,000	22,000
November	127,000	93,000	23,000

"The conditions here shown are believed to be illustrative of the effect of forests upon stream flow, and the comparative effects of cultivation and barrenness. We have found it a rule that the heavier forested catchments furnish a steadier flow, better sustained during dry periods, and that while they are subject once in a great while to severe floods, nevertheless floods not quite so severe are less frequent than upon deforested catch-

ments not highly cultivated. Flood-flow, it must be remembered, however, is largely a matter of topography, and while floods are heavy and frequent upon the deforested Raritan and Neshaminy, the same is true of the well-forested Ramapo and Pequannock, while they are extremely light upon the lightly-wooded Pequest. The economic importance of the effect we have noted lies in the greater value of forested streams for water power, and the smaller storage reservoirs needed thereon to furnish a given daily supply of water to cities. Illustrative of this, the Passaic will furnish for 9 months of the year from 100 square miles of watershed, 45-horse power on 10 feet fall, whereas the Raritan will furnish but 41 and the barren water-shed 28-horse power. During the other three months the Passaic will furnish an average of 36, the Raritan 32 and the barren water-shed 20-horse power. To collect 570,000 gallons per square mile of water-shed, we shall need storage reservoirs of the following capacity: Passaic, 84,000,000, Raritan, 110,000,000, and barren water-shed, 126,000,000 gallons. The difference in cost of collecting a supply at the above rate per square mile, therefore, upon the type of streams selected to represent the forested and those representing the barren conditions, would be about $8,400 per square mile. Both the Passaic and Raritan exceed 800 square miles in catchment. For this area the saving would be $6,720,000.

"Taking the same area, we find the excess of water power of the forested stream would be for 100 feet fall, 1,360-horse power, the value of which, at a rental of $35 per horse power per annum, would be $47,600 or the interest at 5 per cent on $952,000.

"We do not advance these figures as exact measures of the value of forests, but they may be taken as indicative of the possible financial loss which might result in stream flow alone from deforesting such of our water-sheds as are not adapted for cultivation.

"It will also be seen how amply this effect of forests in increasing the stream-flow for 5 or 6 months during the latter part of a dry period justifies popular opinion as to a falling off of streams when the forests are cut off. Such effect is very much more likely to impress itself upon the popular mind than increase of evaporation, for this would tend to decrease the total run-off for the year without being very apparent to ordinary observation. Being a much more enduring effect, it would also be more noticeable than any change in the very greatest or least rate of discharge.

"Most of the portion of the state now in forest is not adapted to cultivation. It should remain in forest, because it will in no other way yield revenue; because it is needed to maintain the equable flow of our streams, and bcause it renders beautiful what would otherwise be an unsightly waste. Unless the state is prepared to assume the ownership of forest lands, the continued good condition of the forests can only be secured by instructing the owners how they can improve this condition, and, at the same time, increase their revenues. It is especially important that our Highlands forests, for the future gathering-grounds for our city water supply, shall continue to be preserved and improved, as they undoubtedly have improved during the last quarter century."

Statements of Authorities.

Says Mr. Charles A. Stone, of the firm of Stone & Webster, Electrical Engineers, Boston, Mass.:

"One of the most important features in the commercial development of a waterpower enterprise is the uniformity of flow of the stream on which the development is undertaken. Where streams are subject to severe droughts or great floods, commercial development is practically impossible. Nature has provided for the uniformity of flow by covering the water-sheds at the headwaters of these streams with forests..... When these forests are cut off, conditions are entirely changed, and great freshets result."

Mr. Theophilus Parsons, a representative of the manufacturing interests of New England, says:

"New England is largely dependent upon her factories run by water-power. The flow of the rivers furnishing this power is growing yearly more uncertain. Both floods and droughts are more frequent. It is plenty or famine. This situation is due to the pernicious cutting of woods along the headwaters of the New England rivers.

"I have known the Connecticut for over thirty-six years. It drains an area of four thousand square miles. Until recently the wooded hills kept the flow of the river even. Now, in the spring, we have floods, while in the summer the water sometimes will not run our mills.

"This is a question in which every manufacturer on the eastern coast of the United States is interested."

In "Forest Influences" Mr. B. C. Fernow says, "Snow will lie

in the forest more evenly and continuously than on the open, wind-swept areas. Thereby not only the amount finally remaining for drainage is increased, but the soil is prevented from freezing, and is kept open for percolation when the snow melts. The retardation of the melting has been determined by Bühler in Switzerland to be from eight to fourteen days."

Honorable Robert M. LaFollette said in his message as Governor of Wisconsin in 1905:

"Probably not more than half a dozen states in the Union, are so abundantly supplied with natural waterpower as Wisconsin, and no state in the middle west is comparable to it in this respect. More than one thousand lakes, widely distributed within its borders, form natural reservoirs, furnishing sources of supply to the streams which flow through every section of the state.

"We have recently undertaken, at considerable expense, the establishment of a forestry commission with a view of preserving whatever remains of the forests upon state lands not suited to agriculture, and the reforesting of these, and such other lands as can most profitably be used for that purpose. The state forestry legislation, adopted two years ago, very defective in many respects, will, it is hoped, be so amended as to establish this important work upon a permanent and efficient basis. It is referred to in this connection because the preservation of our forests and the reforesting of lands about the sources and along the headwaters of our principal streams, are absolutely essential to the preservation of Wisconsin's splendid waterpowers. The restoration of our forests, and the preservation of our waterpowers go hand in hand."

Governor James O. Davidson in his message in 1909, said: "Our forest reserve now comprises 300,000 acres of land, situated in seventeen counties of the state. During the past two years the state has purchased, through the department [of forestry] about 34,000 acres of cut-over lands, as an addition to the reserves in Iron, Vilas and Oneida counties, and has entered into a contract to purchase 14,000 more acres in Vilas county. These lands will, in time, be of great value to the state in timber produce, but their greatest value is in protecting the water powers thereon. The lands preserved by the state are not of value for agricultural purposes and have been purchased at a small outlay. The acquiring of other lands for forestry purposes, especially on or near the headwaters of our streams, should be encouraged."

The Governors of all the states, at the White House conference in May, 1908, adopted the following declaration of principles:

"We urge the continuation and extension of forest policies adapted to secure the husbanding and renewal of our diminishing timber supply, the prevention of soil erosion, the protection of headwaters, and the maintenance of the purity and navigability of our streams. We recognize that the private ownership of forest lands entails responsibilities in the interests of all the people and we favor the enactment of laws looking to the protection and replacement of privately owned forests.

We recognize in our waters a most valuable asset of the people of the United States, and we recommend the enactment of laws looking to the conservation of water resources for irrigation, water supply, power and navigation, to the end that navigable and source streams may be brought under complete control and fully utilized for every purpose. We especially urge on the Federal Congress the immediate adoption of a wise, active and thorough waterway policy, providing for the prompt improvement of our streams and the conservation of their watersheds required for the uses of commerce and the protection of the interests of our people."

The letter of President Roosevelt transmitting to Congress the report of the National Conservation commission contained the following passage: "I especially commend to the Congress the facts presented by the commission as to the relation between forests and stream flow in its bearing upon the importance of the forests lands in national ownership. Without an understanding of this intimate relation the conservation of both these natural resources must largely fail."

The North American Conservation conference representing Canada, Mexico and the United States made a declaration of principles, which contained the following:

"We recognize the forests as indispensable to civilization and public welfare. They furnish material for construction and manufacture, and promote the habitability of the earth. We regard the wise use, effective protection, especially from fire, and prompt renewal of the forests on lands best adapted to such use, as a public necessity and hence a public duty devolving upon all forest owners alike, whether public, corporate or individual.

"Forests are necessary to protect the sources of streams, mod-

erate floods and equalize the flow of waters, temper the climate and protect the soil; and we agree that all forests necessary for these purposes should be amply safeguarded. We affirm the absolute need of holding for forests, or reforesting all lands supplying the headwaters of streams, and we therefore favor the control or acquisition of such lands for the public."

It is estimated that Wisconsin is blessed with approximately 1,000,000 horse power in hundreds of water powers widely distributed over the state. Such a wealth of water powers which in a few years will all be harnessed and made to convey energy to nearly every city and town, means everything to the future of the state, provided that reasonable, common sense methods of stream conservation, which have been tried and long since proven in old countries, are adopted. The value of our streams for water power development will rest almost entirely upon the evenness and uniformity of their flow. Wisconsin is remarkably fortunate in having such a network of lakes and swamps at the headwaters of her important rivers, as these catch and hold the spring freshets and their capacity can be greatly enlarged by building dams. The lands draining into these lakes at the headwaters of the rivers should be included within the forest reserves and the forest growth protected.

Fortunately most of these lands are not as valuable for agricultural crops as for timber, and therefore it will not be necessary to keep forests on lands which should be made into farms.

THE PRINCIPLES OF FORESTRY SHOULD BE TAUGHT IN THE SCHOOLS.

The preservation of the forest resources of this country is such a great economic problem and one that must be solved so largely through educational channels so that all our people shall clearly understand what constitutes proper forest management, that it would seem that the time has arrived when the fundamental principles of forestry should be taught in the public schools. Such instruction is especially important in the forest portions of the state as so many of the pupils will be engaged in some branch of the wood using industry or will locate upon the farm where the proper management of the woodlot is of considerable importance.

The enormous and unnecesary losses from forest fires should be especially emphasized, for Americans as a rule are criminally careless in the use of fires in the forests, but much of such carelessness comes from ignorance and not stopping to think of the consequences, and the best time to drive home the lesson is when the man is a boy. Such instruction if properly given is not dry but can be made a real live interest to every boy and girl. Mr. Hugo A. Winkenwerder, author of Circular No. 130 of the Forest Service on "Forestry in the Public Schools," says in his introduction:

"It is not the object of this circular to advocate the addition of another study to the public school curriculum. In many cases it is already too cumbersome. But with the changes in our economic, political, and social conditions, and with the progress made in the sciences, it is necessary to adapt our present courses to the new conditions. Teachers often feel that their lot is a hard one because they are required to buy new books and to attend lectures and summer schools in order that they may keep up with the continual changes. Though the teacher's salary is often incommensurate with the things required, it is very evident that teachers must keep alive to the new conditions to be of real service.

"The progres of forestry and the forest movement in this coun-

try must be numbered among these changes. Teachers are now interested in the subject of forestry, and a point has been reached where it deserves attention in public school teaching. The text-books which should give a place to it are generally far behind the movement and revisions should remedy this as new editions come out. There is now but little reason for the appearance of geographies, botanies, and certain other texts without a just share of the space devoted to forestry. On the other hand the energetic teacher will not wait for a new text, but will secure the necessary information and present it to the classes.

"Forestry should not be taught in the public schools as a separate study, nor should it take up technical details of the actual practice of forestry except to a limited extent in agricultural high schools. Where, then, does it belong? The answer to this question should be sought in the ultimate object of all public school instruction. It is sometimes forgotten that the business of teaching is not the mere presentation of facts, but to train the mind and body in such a manner that the child can cope successfully with the problems, private and public, which later confront him in his daily life as a citizen. Teachers cannot accomplish this end unless they correlate the work of the school with the things going on in the world outside.

"The child should be made to take an active interest in the important problems before Americans as a people, and be set to thinking about these problems in connection with his school work. If a teacher of history does not interest his pupils in the coming elections and cause them to apply their past instruction to the questions which should decide the vote, he fails to correlate the life of the school with that of the world. Likewise, if a teacher of geography, in discussing river and harbor improvements, does not create an active interest in any local improvements that may be under way, an opporunity is missed. Thus forestry should be taught as an integral part of related subjects. The work of the school should treat forestry as one of the important economic and public questions in the life of the world.

"Teachers are aware that there are now before the people many problems which are interwoven with forestry, and that our citizens are seeking information to enable them to act wisely when these problems confront them.

"It is unfortunate that little is now taught in the public schools which the teacher can use as a foundation for inculcating right

views concerning these problems. For example, suppose the teacher lives in a little town on the Ohio River—a town that is being menaced by ever-increasing floods. The teacher of geography may tell pupils that these floods are due to the removal of the forests from the Appalachian Mountains, and that, as the forests are further removed, the floods will become worse and worse; but the pupils have possibly not been taught anything about the influence of forests upon stream flow and so do not really understand the situation. They are told a bare external fact and that is the end of it.

"But suppose they have been taught in their nature-study work to observe what becomes of rain water and snow water, how exposed soil is washed and gullied, and whither the muddy little torrents transport their burden; how various kinds of vegetation modify these effects; how gently the rain falls and how slowly the snow melts in the woods, and how absorptive is the forest soil—in other words, the every-day facts of erosion as they may be seen in every child's dooryard. Can it be doubted that the lesson of the flood as related to forest destruction would come home in terms of living experience."

Those who are interested in this matter are referred to the above circular which explains just how forestry can be taught in connection with other courses and also gives a list of reference pamphlets and reports, most of which can be secured from the Forest Service, Washington, D. C., free of cost.

FOREST RESERVES AS INVESTMENTS.

As explained in this report the state should acquire a forest reserve of approximately 2,000,000 acres in the wonderful lake region of northern Wisconsin, in order to protect the headwaters of our most important rivers, supply a portion of the timber that will be needed to retain our wood-using industries within the state, and to preserve this beautiful lake country as a great summer resort for all the citizens of Wisconsin and of other states as well. The state will gain materially by securing the above results.

Protecting the headwaters of our rivers will mean that the stream flow will be more uniform, therefore more horse power will be developed in the water powers and bigger mills with a larger output will be the result.

In time the timber that can be produced on 2,000,000 acres of land under forestry management will be a big factor in supplying the wood-using industries with their raw material, and thereby saving these industries to the state.

Our northern lake region, when it is included in a big forest reserve and protected, will bring tourists, campers, fishermen and hunters from all over the country and they will annually spend millions in the state, and largely in the northern portion where it is most needed.

Thus it will be seen that the people of the whole state will indirectly gain very greatly by the proposed forest reserves, but what of the direct returns, or in other words, what revenue can the state hope to receive in time from the reserves, for it should always be remembered that the purchase of a forest reserve is an investment, that forestry is a business and not a fad, and that it must show a reasonable return upon the capital invested.

If Wisconsin had been as wise as Minnesota and retained its timber lands instead of selling them, the forester would have a going concern and the timber would be his stock, which he would sell as it became mature, and thus be able to show a revenue at once. But Wisconsin chose in the past to sell its timber lands to

anyone and everyone, at a fraction of what their present value would be, and therefore the state must buy back the timber lands that it sold, only now thousands of acres have been cut over and burned and hence it will be many years before there will be much merchantable timber to sell. However, the bright side is that much of the timber that was left is now, with increasing demands, becoming valuable. It is very difficult to foretell wnat timber will be worth twenty-five or fifty years from today, but it is, at least, safe to say that it will be much higher.

Taking into consideration the acreage of land within the forest reserves that is now fairly well timbered, and the acreage of cut-over land that contains only a small amount of timber and also the land that must be planted, it is not probable that in twenty-five years the state would receive a net revenue of over $1.00 per acre, but at the end of fifty years, this should have risen to at least $2.00 per acre. It should be explained that the revenue from firewood and all other forest products is included in this estimate, also the revenues from leasing camp and cottage sites, which will be very considerable. If then the state acquires by purchase a forest reserve of 2,000,000 acres or 1,660,000 acres in addition to the 340,000 acres it now owns, it should be able to count on a net annual revenue of $2,000,000 after twenty-five years and of $4,000,000 after fifty years.

In this connection the following facts in regard to "What Forestry Has Done," taken from circular No. 140 of the Forest Service by Treadwell Cleveland, Jr., will be of interest:

Many people in this country think that forestry had never been tried until the Government began to practice it upon the National Forests. Yet forestry is practiced by every civilized country in the world, except China and Turkey. It gets results which can be got in no other way, and which are necessary to the general welfare. Forestry is not a new thing. It was discussed two thousand years ago, and it has been studied and applied with increasing thoroughness ever since.

The principles of forestry are everywhere the same. They rest on natural laws, which are at work everywhere and all the time. It is simply a question of how best to apply these laws to fit local needs and conditions. No matter how widely countries may differ in size, climate, population, industry, or government, provided only they have forests, all of them must come to forestry some time as a matter of necessity.

The more advanced and progressive countries arrive first and go farthest in forestry, as they do in other things. Indeed, we might almost take forestry as a yardstick with which to measure the height of a civilization. On the one hand, the nations which follow forestry most widely and systematically would be found to be the most enlightened nations. On the other hand, when we applied our yardstick to such countries as are without foresty, we could say with a good deal of assurance, by this test alone, "Here is a backward nation."

A singular and suggestive exception is England, which, though provided with mountain and heath lands capable of producing a large part of the wood for home consumption, has, with strange indifference, been leading all nations in volume of wood imports and depending mainly upon foreign sources for her supplies. England has hitherto been able to count with certainty upon outside aid from such near neighbors as Norway and Sweden. This policy has seemed satisfactory to the people in spite of the examples of a more provident policy afforded by rival nations almost at her door. The geographical and economic positions of the country have permitted the government, for the time at least to ignore measures found necessary for the public welfare in other countries of the same rank.

The countries of Europe and Asia, taken together, have passed through all the stages of forest history and applied all the known principles of forestry. They are rich in forest experience. The lessons of forestry were brought home to them by hard knocks. Their forest systems were built up gradually as the result of hardship. They did not first spin fine theories and then apply those theories by main force. On the contrary, they began by facing disagreeable facts. Every step of the way toward wise forest use, the world over, has been made at the sharp spur of want, suffering, or loss. As a result, the science of forestry is one of the most practical and most directly useful of all the sciences. It is a serious work, undertaken as a measure of relief, and continued as a safeguard against future calamity.

Roughly, those countries which to-day manage their forests on sound principles have passed through four stages of forest experience. At first the forests were so abundant as to be in the way, and so they were either neglected or destroyed. Next, as settlements grew and the borders of the forest receded farther and farther from the places where wood was needed and used, the

question of local wood supplies had to be faced, and the forest was spared or even protected. Third, the increasing need of wood, together with better knowledge of the forest and its growth, led to the recognition of the forest as a crop, like agricultural crops, which must be harvested and which should therefore be made to grow again. In this stage silviculture, or the management of the forest so as to encourage its continued best growth, was born. Finally, as natural and industrial progress led to measures for the general welfare, including a wiser and less wasteful use of natural resources, the forest was safeguarded and controlled so as to yield a constant maximum product year after year and from one generation to another. Systematic forestry, therefore, applied by the nation for the benefit of the people and practiced increasingly by farsighted private citizens, comes when the last lesson in the school of forest experience is mastered.

The United States, then, in attacking the problem of how best to use its great forest resources, is not in the position of a pioneer in the field. It has the experience of all other countries to go upon. There is no need for years of experiment with untried theories. The forest principles which hundreds of years of actual practice have proved right are at its command. The only question is, how should these be modified or extended to best meet American conditions. In the management of the National Forests the Government is not working in the dark. Nor is it slavishly copying European countries. It is putting into practice, in America, and for Americans, principles tried and found correct, which will insure to all the people alike the fullest and best use of all forest resources.

In the following short history of what forestry has done in other countries, it will be possible to give only the chief facts. Yet even in this incomplete review two things stand out with striking clearness. One is that those countries which have gone farthest in the practice of forestry are the ones which to-day are most prosperous, which have the least proportion of waste land, and which have the most promising futures. The other is that those countries which spend most upon their forests receive from them the greatest net returns.

GERMANY.

The German Empire has nearly 35,000,000 acres of forest, of which 31.9 per cent belongs to the State, 1.8 per cent to the Crown, 16.1 per cent to communities, 46.5 per cent to private persons, 1.6 per cent to corporations, and the remaineder to institutions and associations. There is a little over three-fifths of an acre of forest for each citizen, and though 53 cubic feet of wood to the acre is produced in a year, wood imports have increasingly exceeded wood exports for over forty years, and 300,000,000 cubic feet, valued at $80,000,000, or over one-sixth of the home consumption is now imported each year. Germany's drains on foreign countries are in the following order: Austria-Hungary, 19,750,000 tons; Russia and Finland, 18,000,000 tons; Sweden, 508,000 tons; the United States, 360,000 tons; Norway, 49,000 tons.[1]

German forestry is remarkable in three ways. It has always led in scientific thoroughness, and now it is working out results with an exactness almost equal to that of the laboratory; it has applied this scientific knowledge with the greatest technical success; and it has solved the problem of securing through a long series of years an increasing forest output and increasing profits at the same time.

Like other advanced European countries, Germany felt the pinch of wood shortage a hundred and fifty years ago, and though this shortage was relieved by the coming of the railroads, which opened up new forests, and by the use of coal, which substituted a new fuel for wood, the warning was heeded, and systematic State forestry was begun. After all, the scare was not a false one, for even to-day Germany is not independent as regards wood, since she has to import one-sixth of all she uses.

In addition to the wood-supply question, Germany was forced to undertake forestry by the need of protecting agriculture and stream flow. The troubles which France was having with her mountain torrents opened the eyes of the Germans to the dangers from floods in their own land. As a result the maintenance of protective forests was provided for by Bavaria in 1852, by Prussia in 1875, and by Württemberg in 1879.

---

[1] According to the kind of wood, a ton is equivalent to from about 500 to about 1,000 board feet.

Each State of the German federation administers its own forests. All of the States practice forestry with success. The results obtained by Prussia and Saxony are particularly interesting, for they show how forests may be kept constantly improving under a system of management which yields a handsome profit.

The Prussian forests, covering nearly 7,000,000 acres, are made up much as if we should combine the pineries of the Southern States with the forests of some of our Middle Atlantic and Central States. When forestry was begun a great part of them had been injured by mismanagement, much as our forests have been, and the Prussian foresters had to solve the problem of improving the run-down forests out of the returns from those which were still in good condition. They solved it with striking success. Immense improvement has already taken place and is steadily going on.

The method of management adopted calls for a sustained yield—that is, no more wood is cut than the forest produces. Under this management the growth of the forest, and consequently the amount cut, has risen sharply. In 1830 the yeild was 20 cubic feet per acre; in 1865, 24 cubic feet; in 1890, 52 cubic feet, and in 1904, 65 cubic feet. In other words, Prussian forest management has multiplied the rate of production threefold in seventy-five years. And the quality of the product has improved with the quantity. Between 1830 and 1904 the percentage of saw timber rose from 19 per cent to 54 per cent.

It is a striking fact in this connection that in the United States at the present time we are using about three times as much timber as our forests grow. If we were everywhere practicing forestry with a resulting improvement equal to that made in Prussia, our forests would be growing as much as we use.

The financial returns in Prussia make an even better showing. Net returns per acre in 1850 were 28 cents. In 1865 they were 72 cents; in 1900, $1.58; and in 1904, $2.50. They are now nearly 10 times what they were sixty years ago, and they are increasing more rapidly than ever.

These results have been obtained in Prussia along with almost ideal technical success. When what is wanted is a sustained yield from the forest year by year in the long run, it is clearly necessary to have always a certain number of trees ready to be cut; there must be a proper proportion of trees of all ages. This percentage has been secured and maintained with almost mathematical accuracy.

In Saxony, which has about 430,000 acres of State forests, the increase of cut under forest management, which always means also a corresponding increase in wood produced, has been nearly as marked as in Prussia. The yield rose 55 per cent between 1820 and 1904, and is now 93 cubic feet per acre—greater than that of the Prussian forests. Since the chief wood is spruce, which yields more saw timber than the average of trees making up the Prussian forests, the increase in the percentage of saw timber in Saxony naturally exceeds the increase in Prussia. It increased from 26 per cent in 1830 to 66 per cent in 1904. The net yearly revenue is $5.30 per acre. The yearly expense is $3 per acre.

These figures are in striking contrast with the corresponding ones for the United States, given in the table on page 20. We spent on our National Forests last year 9 3-10 mills per acre, and our net revenue from them was less than ⅞ mill per acre.

The rise in prices, felt everywhere, accounts only in part for the increased financial returns from forestry in these two States. For while the prices have not quite trebled, the revenue has been multiplied tenfold.

Other German States, smaller, and with better kinds of timber and better market facilities, secure even higher returns. The forests of Württemberg yield a net annual revenue of nearly $6 per acre, and those of several smaller administrations do even better.

A number of the private forests of Germany are managed with great success. As a result of a canvass of 15,600,000 acres of State, municipal, and private forests, it was found that the average net revenue per acre, from good, bad, and indifferent land, was $2.40 a year.

What, then, has forestry done in Germany? Starting with forests which were in as bad shape as many of our own which have been recklessly cut over, it raised the average yield of wood per acre from 20 cubic feet in 1830 to 65 cubic feet in 1904. During the same period of time it trebled the proportion of saw timber got from the average cut, which means, in other words, that through the practice of forestry the timberlands of Germany are of three times better quality to-day than when no system was used. And in fifty-four years it increased the money returns from an average acre of forest sevenfold.

Yet to-day the forests are in better condition than ever before,

and under the present system of management it is possible for the German foresters to say with absolute certainty that the high yield and large returns which the forests now give will be continued indefinitely into the future.

FRANCE.

France has not quite 18 per cent of forest—three-fifths of an acre per capita. This is enough to produce only one-third of the home demand. The country imports annually $30,000,000 worth of wood, and pays $6,000,000 duty and $10,000,000 freight for it. This wood comes from Russia, Sweden, Norway, Austria-Hungary, Germany and America. Of the 23,500,000 acres of French forests the State owns 2,707,000, and the Departments and communes 3,472,000. Since 1827, when the forest code was passed, the State and communal forests have been under management. The State forests yield a clear profit of $4,737,250 a year, or $1.75 per acre; $0.95 is spent for the management of each acre every year.

The best managed State forests yield about 40 cubic feet per acre a year, which is low compared with the yield of some other European forests, such as those of Prussia, Saxony, or Württemberg.

The great achievement of France in forestry has been the establishment of protective forests where much destruction had been caused by floods and winds. From various causes large areas were cleared of forests toward the close of the eighteenth century, and only when it was too late was it realized that these lands were not fit for agriculture and should have been left in forest. To repair the mistake, a movement to reforest began in the nineteenth century. It was an exceedingly expensive mistake. Down to the present time, encouraged by wise laws, the State, the communes, and private landowners have restored to forest over 2,500,000 acres, and so saved them from ruin. In addition, the resulting forests return an excellent revenue.

Two-thirds of the torrents of Europe are in France. In the Alps, the Cevennes, and the Pyrenees mountains there are 1,462 brooks and mountain streams which are considered dangerous. Nearly a million acres of mountain slopes are exposed to erosion by these streams, to say nothing of the flat land below.

As far back as the sixteenth century there were local restric-

tions against clearing mountain sides, enforced by fines, confiscation, and corporal punishment. In the main these prevented ruinous stripping of hillsides, but with the French Revolution these restrictions were swept aside and the mountains were cleared at such a rate that disastrous effects were felt within ten years. By 1803 the people had become aroused to the folly of this cutting. Where useful brooks had been there now rushed torrents which flooded the fertile fields and covered them with sterile soil washed down from the mountains. The clearing continued unchecked until some 800,000 acres of farm land had been ruined or seriously injured, and the population of eighteen Departments had been reduced to poverty and forced to emigrate. By 1860 the State took up the problem, but in such a way that the burden of expense for reforestation was thrown upon the mountaineers, who, moreover, were deprived of much pasturage. Complaints naturally arose. An attempt was made to check torrents by sodding instead of by forest planting. This, however, proved a failure, and recourse was again had to planting, by the law of 1882, which provides that the State shall bear the costs. Since then the excellent results of planting have completely changed public sentiment. The mountaineers are most eager to have the work go on and are ready to offer their land for nothing to the forest department. In addition to lands secured by gift, the State acquires 25,000 or 30,000 acres a year. Over 500,000 acres have been acquired and more than one-half of this area has been planted. Already 163 of the torrents have been entirely controlled and 654 are beginning to show the controlling effects of the forest on their watersheds. Thirty-one of the torrents now entirely controlled were considered hopelessly bad half a century ago.

It is expected that $50,000,000 will have been spent before the work of reforesting for protection is complete.

The sand dunes on the coast of France, mainly in Gascony, which the winds drove farther and farther inland, wasting the vineyards, have now largely been fixed in place by forest plantations which were begun in 1793. Of the 350,000 acres of sand dunes 275,000 have been planted in forest, and the dunes, instead of being a constant menace to the neighboring farmers, now are growing crops of pine which produce valuable wood and resin. In all, about $2,000,000 was spent in the work and an additional $700,000 was laid out in bringing the forests under

administration. Now, though about one-half of the lands have been acquired by private persons and the State retains only about 125,000 acres, the State has received $120,000 above all expenses, and possesses a property worth $10,000,000, acquired virtually for nothing.

Some 2,000,000 acres of shifting sands and marshes toward the interior of the country, a triangular territory known as the Landes, has been changed from a formerly worthless condition into a profitable forest valued at $100,000,000. Reforestation was begun about the middle of the last century. This work was done principally by the communes, aided and imitated by private owners, and encouraged by the State. The resulting forest produces both pine timber and resin, upon the yield of which the present valuation is based.

La Sologne, in the central part of the country between the rivers Loire and Cher, were once densely wooded, but was for two centuries steadily deforested. By the beginning of the nineteenth century 1,250,000 acres had been utterly abandoned. Owing to the nature of the soil and subsoil, drainage was necessary as a first step toward reclaiming this land with forest. About the middle of the nineteenth century a committee of private citizens, under the presidency of the director-general of forests, began the work of reclamation. A canal 25 miles long and 350 miles of road were built, and 200,000 acres of non-agricultural land were planted with pine. In spite of the fact that one of the species planted proved a failure and another kind of pine had to be substituted, the reforestation work has resulted in a forest property worth $18,000,000, and land which could be bought for $4 an acre fifty years ago is now yielding $3 an acre net annual revenue.

The arid limestone wastes of the province of Champagne have been partly reclaimed by forest planting. Two hundred thousand acres, planted at a cost of $10 per acre, have now risen in value from $4 to $40 per acre, with a total value of $10,000,000 and a net annual revenue of $2 per acre.

The private forests of France are being freely sold. Speculators buy them, strip them, and sell them for grazing purposes. In this way hilltops and hillsides are being rapidly denuded. This threatens erosion and the silting of farm lands in the valleys by the washing down of infertile soil. The terribly destructive floods of the present year could not have been so violent had the hills of France been kept clothed in forest.

In France, then, forestry has decreased the danger from floods, which threatened to destroy vast areas of fertile farms, and in doing so has added many millions of dollars to the National wealth in new forests. It has removed the danger from sand dunes; and in their place has created a property worth many millions of dollars. Applied to the State forests, which are small in comparison with the National Forests of this country, it causes them to yield each year a net revenue of more than $4,700,000, though the sum spent on each acre for management is over 100 times greater than that spent on the forests of the United States.

France and Germany together have a population of 100,000,000, in round numbers, against our probable 85,000,000, and State forests of 14,500,000 acres against our 160,000,000 acres of National Forests; but France and Germany spend on their forests $11,000,000 a year and get from them in net returns $30,000,000 a year, while the United States spent on the National Forests last year $1,400,000 and secured a net return of less than $130,000.

SWITZERLAND.

In Switzerland, which has 2,000,000 acres, or 20.6 per cent of its area, in forest, the communal forests are the largest, and make up 67 per cent of the total; the cantons own 4.5 per cent; and private persons own 28.6 per cent. The communal holdings are constantly growing by the purchase of private lands. The general government, or Bund, owns no forests. From $6,000,000 to $8,000,000 worth of wood (300,000 tons) and wooden ware are annually imported. This comes mainly from Austria-Hungary, southern Germany, and France.

The State forests yield about 64 cubic feet per acre, the corporation forests 42 cubic feet; the average yield of both together is about 45 cubic feet. The average wood growth per acre has been estimated to be 50 cubic feet. In the State forests of Bern the figures show a growth of 50 cubic feet for the plateau country, 73 cubic feet for the middle country, and 75 cubic feet in the Jura. Wood prices, which are higher than in Germany, have been rising for forty years.

The expenditures in forest management vary greatly among the Cantons, ranging from $1.50 to $7 per acre. The net annual returns range from $3 per acre in the forests where least is expended, to $8 or $9 per acre in the city forests, where most is expended.

Forest regulations came very early in Switzerland. The first forest ordinance of Bern was issued 600 years ago. The city forest of Zürich, famous as the Sihlwald, has been managed under a working plan since 1680, and is to-day one of the most perfectly managed and most profitable forests in the world. It yields, on the average, a clear annual profit of $12 an acre. From time to time, as the evidence shows, the Swiss people stood in dread of a timber famine. Ordinances were passed forbidding the reduction of the forest area, the making of clearings, and the exportation of wood from one Canton to another. In the middle of the eighteenth century, as modern industrial life began, various Cantons sought to follow the examples which Bern and Zürich had set in forestry. A severe flood in 1830 brought home the need of more vigorous measures in guarding against torrents. The floods of 1834 and 1868 further enforced the lesson. An investigation of Swiss forest conditions was ordered by the Bund in 1857, and the same year provision was made for an annual appropriation of $2,000 to the Swiss Forestry Association for engineering and reforesting work in the Alps. In 1871 the Bundesrath was empowered to carry on this work, with an annual appropriation of $20,000. After the flood of 1868 $200,000 of the collections made for the relief of the sufferers was devoted to reforestation. In 1876 the Bund assumed supervision of the water and forest police in the High Alps above a certain elevation, and undertook to give aid in the work of engineering and reforesting for the control of the Alpine torrents. Since 1898 the Bund has supervised all this work, and in 1902 the present forest policy was firmly fixed by a revision of the existing law.

All the Swiss forests comprised in the Bund are now classified as protection and nonprotection forests. Whether public or private they are all controlled by the government. In protection forests all cuttings must be such as to preserve the protective value of the forest cover intact, and for this reason clean cutting is usually forbidden. In such forest stumpage sales are forbidden, and all wood must be felled and measured under the direction of a forest officer. Otherwise, privately-owned protection forests are supervised in the main as are those publicly owned. Nonprotection forests are also subject to a number of regulations. When they are in private hands clearings may be made only with consent of the Canton, logged areas must be reforested within three years, and existing forest pastures must be maintained.

Where protection forests can be created by planting, this may be ordered, and where forests are converted to farming land or pasture an equal area may be ordered reforested. Where barren ground is required to be forested for protective purposes, the Bund assists by paying from 30 to 50 per cent of the cost. Between 1876 and 1902 16,000 acres were reforested at a cost of $1,000,000, in round numbers, the Bund having paid one-half.

Grazing has been regulated for centuries. In protection forests it is entirely prohibited; but on all the rest of the forests great success has attended the efforts of the forest service to safeguard both pasturage and the forest by supervision and range improvement. Despite differences in local conditions, the experience of Switzerland in forest grazing is, therefore, strongly in support of the policies which are directing the efforts of our own Forest Service. Indeed, the experience of all Europe shows the necessity of controlling the public range.

To sum up, forestry in Switzerland, where every foot of agricultural land is of the greatest value, has made it possible for the people to farm all land fit for crops, and so has assisted the country to support a larger population, and one that is more prosperous, than would be the case if the valleys were subjected to destructive floods. In a country, as small as Switzerland, and one which contains so many high and rugged mountains, this is a service the benefits of which can not be measured in dollars. It is in Switzerland also, in the Sihlwald, that forestry demonstrates beyond contradiction how great a yield in wood and money it may bring about if applied consistently for a number of years.

Norway, Sweden and Denmark.

Norway.

Only 21 per cent, or 20,000,000 acres, of Norway is in forest. The State owns less than 2,000,000 acres of this. Of the forest region one-half has to import timber, one-fourth has sufficient for its needs, and one-fourth is able to export over 1,000,000 tons, valued at $18,000,000 a year. Nearly two-thirds of the exports go to England and most of the rest is divided up between Belgium, Australia, France, Holland, Germany, and Denmark. The total annual cut, one-fifth of which is exported, is about 500,000,000 cubic feet. It exceeds by 1,500,000 cubic feet the amount of wood grown by all the forest in the same time. In other

words, the cut is far too heavy to last, so that a reduction of wood exports is inevitable.

Forestry is on a low level. The various provisions for the better use and protection of the forests, which began three hundred years ago, have been of too half-hearted a nature to meet the situation. There is a forest service, but the officers are few and underpaid, and the districts under their care—sometimes several million acres to each—are far too large for effective work. Moreover, there are difficulties over the forest rights which were earlier granted to encourage the development of the country, but which are now greatly in the way of establishing property rights and organizing an administration.

Since 1860 the State has been buying cut-over lands in order to plant them to forest where forest protection is needed, and from $15,000 to $20,000 a year has been spent in this way during recent years.

The communal forests are supervised by the Government, and are usually managed by the foresters with a view simply to supplying local needs. Sales outside the parishes are permitted only where there is more than enough for these needs.

SWEDEN.

Sweden has nearly 50,000,000 acres of forest, covering nearly 50 per cent of the total land area. Since the English import duties were abolished in 1866 the wood exports from Sweden have steadily increased, till now Sweden stands next to Russia, the world leader, in wood exports, with $54,000,000 worth a year, representing nearly 4,500,000 tons. England takes half of this, followed by France, Denmark, Germany, Holland, Cape Colony, Australia, and South America. The total cut from the forest is estimated to be near 1,000 million cubic feet.

The State owns about 13,500,000 acres, or 33.2 per cent, and controls 4,000,000 acres more. The State lands are, in the main, of lesser commercial value, and this fact, together with the existence of logging rights granted in the past, keeps the net income for the present down to 12 cents an acre. Nevertheless, since 1880 the net revenue from the State forests has risen from $300,000 to nearly $2,000,000 a year.

Up to five hundred years ago Sweden was overburdened by forests, but by that time cutting and wasting had gone so far that

the willful setting of forest fires was forbidden. In 1638 overseers of communal forests were appointed in order to conserve supplies of wood for charcoal used in the iron industry. A general law followed in 1647, and a director of forests in the two southern districts was appointed in 1720. All through the eighteenth century, restrictions upon forest use were in force. Toward the close of the century there was, indeed, a premature scare over a possible timber famine. Yet, despite this legislation, and much legislation which followed, waste continued to go on. While measures were being passed to conserve the forests, the communal forests and town forests were actually being sold. It was not till the law of 1903, which went into effect in January, 1905, that a satisfactory policy was secured. In general, this requires the practice of forestry. As in Russia, provincial forest protection committees have to approve the local felling plans. A diameter limit is set, below which trees may not be cut. Clearings are forbidden, and cleared land, unless used for other purposes, must be reforested. Pasturing is restricted where it would do harm.

In the past thirty-five years the State has increased its forest holdings by 45 per cent through the purchase and reforesting of wastes and sand dunes and by the settlement of disputed titles. The purchases amount to over 600,000 acres, for which an average price of $5.30 an acre was paid.

Lumbering is carried on much as it is in the United States. The State, as a rule, sells stumpage, and the timber is removed by contractors. Management is by no means so detailed and intensive as in Germany or France. The trees which are to be cut are marked, but no attempt is ordinarily made to prepare complete working plans. Only a moderate amount of planting is done to secure the future crop, and natural reproduction is mainly relied upon.

Forest fires continue to do great damage, especially in the northern part of the country. A forest patrol is doing effective work, however, in checking the spread of fires.

DENMARK.

Denmark has about 600,000 acres under forest, of which the State owns over 23 per cent, or 142,000 acres. About 75,000 acres of wastes are in process of reforestation.

The need of wiser forest use was felt in the eighteenth century, and by 1781 the State forests were placed under administration. But the clearing of the forest continued at such a rate that in 1805 it was provided that the still existing forests of beech and oak should be maintained forever. Further, provision was made as to the selling of the peasants' farms, so that they should not be accumulated in large holdings upon which the peasants would have to depend for their wood.

Since 1820 the forest area has been increasing. At present reforesting is adding to it very considerably. Nearly 200,000 acres of heath have been planted in the last forty years. To this work of reclamation the State contributes $40,000 a year.

In State forests, as well as in the communal forests and the farmer's woodlots, forestry is carefully and profitably practiced.

FOREST RESERVES AS GAME PRESERVES.

As Ex-President Roosevelt has so well pointed out, the National forests as well as the forest reserves maintained by the various states are intended for the fullest and best use consistent with their protection, and one of the most natural uses to which a portion of the reserves should be put is as game preserves for all kinds of wild game.

As stated in this report the forest reserves in time should be used very extensively as a summer resort and by campers, hunters and fishermen. Much of the attraction of the reserves will depend on whether there is good hunting and fishing, and if these are provided sportsmen and tourists will spend a large amount of money in the state.

Wisconsin propagates through its fish hatcheries many kinds of fish to stock the waters but so far the state has done nothing outside of enforcing the game laws towards maintaining or increasing the supply of wild game. Now that the state has a forest reserve it would not entail a great expense to enclose, say, 10,000 acres within a game proof wire fence and authorize the State Fish and Game Warden to use such funds as are available from time to time in stocking it. The area to be enclosed should include lakes and forests so as to have favorable conditions for raising such valuable fur bearing animals as mink, beaver and otter, game birds such as partridge and pheasant, also white and black tailed deer and possibly in time moose, caribou and elk, As the game increased it should be distributed in all parts of the forest reserves and in other parts of the state where it would receive adequate protection. The area of the game preserve could be increased when necessary and one or two forest rangers could easily look after the game and still be able to attend to a good deal of forest work. It is hoped that the legislature will authorize the State Fish and Game Warden and the State Board of Forestry to co-operate in establishing and gradually stocking a game preserve.

THE STATE WILL LEASE CAMP AND COTTAGE SITES.

The State Board of Forestry has adopted the policy of leasing camp and cottage sites upon the shores of the beautiful lakes within the forest reserve. Owning several thousand acres of land upon the shores of some of the most attractive lakes in Oneida and Vilas counties, the state is easily able to meet all present demands and can lease sites to suit almost any taste.

From ten to twenty acres will be leased to one person or family and as much more to a club or association as they may really need. Leases can be given for a period of twenty years with the privilege of renewal and the yearly rental will vary from $10 to $50 according to the size of the lot required, its location and the amount of timber upon it. The contract between the state and the lessee is very simple, merely providing that the lessee will cut only such timber as is marked for cutting by the forester, pay the local price for such logs as he may use in building, use all possible care in building fires, agree not to sell liquor on the premises or to sublet without the consent of the Board. For a small additional sum, merely sufficient to cover the cost, the forest rangers will look after a camp or cottage during the winter months, or while the owner is away.

The Forestry Board however have no cottages to rent, nor can they build cottages or sell the building materials, except logs from the forest reserve. Cottage sites will be leased not only to residents of Wisconsin but of other states as well.

The forest reserve region should become in time a great summer resort for people throughout the entire Mississippi valley, as it has a fine, bracing dry climate, pine forests and sandy soil and is blessed with many of the finest chains of lakes in the entire country. Vilas county in particular has a greater area of water than land and long trips can be made by launch or canoe. There is plenty of sport both for hunters and fishermen and the resorts furnish good beds and excellent board at reasonable prices.

The summer resort business in northern New York state amounts to approximately $10,000,000 a year, this amount being

paid by the tourists, as they are called, in railroad fares, to hotels, boarding houses, and for guides, teams, boats, etc. New Hampshire does about as well and the summer business gives the old state of Maine nearly $20,000,000 a year.

This shows that it will well pay Wisconsin to protect its beautiful northern lakes, but if the lake shores and surrounding forests are ruined by annually recurring fires they will cease to be attractive in any sense and the summer trade will go elsewhere.

It would seem that there should be many families in the state who would like to avail themselves of this opportunity to secure an attractive site upon one of the lakes within the forest reserves. The Board is anxious to encourage the best utilization of the forest reserves as far as possible, and it is believed that the forest reserve region especially in Oneida and Vilas counties is far more valuable for development as a great resort than for any other purpose, and if this area is protected and everything done to make it attractive, it will mean lasting prosperity for all the residents of that section.

Those applying for cottage sites should specify the lake where they wish to build, or if they art not familiar with the lakes they should state whether they wish to be near the railroads and public resorts or farther back on some lake away from all the signs of civilization.

The State Board of Forestry can supply maps showing the location of all state forest reserve lands on the lakes, and also detailed information as to any particular lot.

HEADQUARTERS OF THE FOREST RESERVE.

Big Trout lake in Vilas county is in the heart of the forest reserve and in many respects is so favorably located that the headquarters camps will be established there. A small cabin has been built for the use of the rangers who have been employed in cutting fire lines and in clearing the site for the tree nursery.

In the summer of 1911 it is planned to build a camp for the Assistant State Forester, who is in direct charge of the field work on the reserves; a larger camp for all the men who will be employed at or near Trout lake, a tank to supply water to the nurseries, and ice and boat houses.

The state owns six miles of shore line around the lake, and also a very fine growth of Norway pine which stands on a point that extends into the lake from the east shore. Several fire lines must be cut and cleared so that this pine will be absolutely protected from fire; and much of the shore line of this most beautiful lake, which has been cut over and burned, must be planted with young pine.

Just back of the camps a site will be cleared for a large tree nursery, as the state owns thousands of acres of cut-over lands in this region that must be planted just as soon as they can be protected from fire.

The State Board of Forestry would not have been justified in planting its scattering lands, as it could not protect such tracts from fire, but has been compelled to wait until it could purchase the necessary lands to at least partially block up its holdings. The Board has been criticised for this apparent procrastination by those who did not understand the situation.

Most of the young pines will be planted when two to three years old and it is hoped that within this time the state will have acquired enough additional land so that the work of reforestation will not be further delayed.

In addition to the nursery at Trout lake, at least two more large nurseries will be required in order to avoid the heavy expense or hauling the nursery stock long distances. One of these nurseries will probably be established on the south shore of Tomahawk lake and the other on or near Rest lake.

RE-ESTABLISHING LINES AND CORNERS.

The original government surveys in northern Oneida and Vilas counties in the heart of the present forest reserve area were done fairly well and the witness trees were plainly marked and the corners well established. Cutting out such corner or bearing trees should have been punished by a heavy fine, but unfortunately this has not been done and so many of the corners have been destroyed by cutting that they must be again established.

It is proposed to make the section corners and quarter posts out of concrete, and to color the concrete red so that they can be easily seen in the woods and quickly located. For most sections of the reverse the concrete posts can be made at the various ranger cabins and then hauled to where they are to be set up. Where this is too difficult or expensive, iron piping painted red and with a brass cap for the lettering, will be driven into the ground.

The divisions of the forest reserves will be by blocks or compartments, according to the topography, or the manner in which the reserves are naturally divided by rivers, lakes or fire lines, rather than by townships or sections. Still it is important while the location of many of the old corners is still known to re-establish them, and as the state may find it necessary or expedient in future years to sell small tracts for farming or other purposes, it is very important that the original corners and lines should be retained.

RANGERS FOR THE FOREST RESERVE.

A very large amount of work must be done upon the forest reserves in order to protect them from forest fires and also to place the forests, as soon as possible, in such condition that they will begin to yield a steady and increasing revenue to the state.

Since the establishment of this department in 1905 the main work of the Assistant State Forester and the cruisers has been the examination of the forest reserve lands that on account of being badly scattered or agricultural in character, should be sold, and the examination and appraisal of lands to be purchased and added to the forest reserves. This has been a very large piece of work but the examination of the lands to be sold is now practically completed and a large portion of the lands to be purchased have been examined and appraised. By the purchase of lands some parts of the forest reserves have now been blocked up enough so that we are justified for the first time in cutting fire lines, clearing roads and trails, and starting our nurseries to reforest the lands that have been denuded by repeated fires in past years.

The headquarters camp for our main work will be located at Trout lake in Vilas county, and here also we will lay out one of our largest nurseries. At first only about twelve forest rangers will be employed but later on as the work develops, the force will be gradually increased. Cabins will be built for the rangers and their families to live in and they will be located at the most dangerous fire points, so that if fires do occur we will have a trained fire fighter on the spot.

All the ranger cabins will be connected with the headquarters camp by telephone so that when a fire breaks out in any one of the ranger districts, the forester in charge can call all his men together in the shortest possible time. Watch towers, or lookout stations will be built on high knolls, ridges, or other favorable points and in dangerously dry weather men equipped with telescopes will be stationed in them every day with instructions to at once telephone information of any fire, or even smoke, to the nearest ranger and to the headquarters camp.

Each ranger will be obliged to keep one or two saddle horses, as in this way they can cover their districts much more rapidly and save their strength and energy for the various kinds of hard work they will be called upon to do. Such work will consist in building roads, trails, fire lines, telephone lines, building their cabins and camps, burning brush and slash, marking mature timber to be sold, laying out nurseries and planting denuded areas, and the hardest work of all, fighting fire.

These rangers will be appointed after Civil Service examinations so practical in character that there should be no trouble in selecting men well equipped for the work and who can be taught the rudiments of forestry that it is essential that each ranger should know. The men must have tact, as they will come in contact in their work with settlers, lumbermen, resort and cottage owners, campers, hunters, fishermen, etc., and must know how to treat them pleasantly and respectfully, and still strictly enforce the laws and regulations governing the forest reserves. They must be good woodsmen and good axemen, with a natural liking for the woods and the life of the pioneer. The men will be paid $50.00 to $90.00 per month and their promotion should depend absolutely upon their ability, energy and general fitness and not in the least upon their age or length of service.

BUILDING FIRE LINES, ROADS AND TRAILS.

Fire Lines.

Fire lines, or fire lanes as they are sometimes called, are strips from 100 to 300 feet wide which are cut through the forest and cleared of all inflammable material, and as an additional safeguard a strip is then plowed. The following account of the Michigan Forestry commission shows their opinion as to the value of such fire lines.

".....The lines are first surveyed and brushed out, and are then plowed with an ordinary breaking plow, the plowed strip varying from ½ to 1 rod in width. From the experience with railway dumps, roads and abandoned fields it is evident that in these level sands, such lines are not readily effaced by the growth of brush and weeds, but remain bare and useful as fire lines for a considerable period, when they can readily and cheaply be freshened up by a disc plow or harrow. The work of constructing these lines was begun in 1905. Over 30 miles of these lines have thus far been plowed out in the rough and the principal network of fire lines for District No. 1 is completed. On the 'plains,' the Jack pine and scrub oak lands with a sparse growth of timber and brush, these lines are as complete as is desired, the plow work being perfect in every detail.

"On the cut and burned-over lands, where large pine stumps, together with brush and coppice growth of oak, etc., present a great variety of obstacles, the first plowing is rough and rather incomplete and the lines will require time and some further improvement to be put in a perfectly satisfactory condition. Nevertheless there is not a rod of these lines which would not stop without any help, any ordinary fire, unless a heavy wind, a hot fire and warm, mid-day conditions should conspire to make the case especially difficult. In actual fighting of fire, these lines will prove of greatest value, and it is evident today that one man with these lines, could do more than a hundred men without them and, what is equally important, do it with far more certainty. 'You are fighting fires before you have any,' a workman correct-

ly put this matter. As to cost of construction these lines vary within wide limits. On the 'plains' they can be brushed and plowed out for as low as $5.00 per acre, or $10.00 per mile, while in 'brushy' lands, with large stumps, and especially on sloping ground, the expenses rise to three and four times the above amount.

"While summer is a good season for work of this kind, our experience would indicate that early spring is better; the ground is more bare, the ground cover is crushed down by the winter's snow, the soil is moist, the weather is cool and the horses suffer less from the ever present insect pest of the region. Single teams of heavy horses have proven more satisfactory than the employment of four-horse teams, especially so in brush and stump lands."

In our reserves the fire lines will rarely be built along the section lines but rather so as to connect two lakes, or a lake or river with a swamp or road. There are so many lakes, rivers and streams within the reserves that by careful selection we can build comparatively short fire lines that will divide the reserves into blocks, so that if a fire does start it can be held to the block in which is originates and will do only a relatively small amount of damage.

The very numerous lakes and streams, supplemented and joined together by broad fire lines kept clear of all inflammable material, should insure our forest reserves against the possibility of any general and widespread destruction by forest fires. This is a most fortunate situation and removes one of the greatest obstacles to the successful forestry management of large tracts of forest land.

Roads.

In order to provide means of communication, so that all parts of the reserve can be reached quickly and easily, several hundred miles of roads and trails must be built. Fortunately most of the reserve already has many miles of old logging railroads and these with a comparatively small amount of work can be made into very fair wood roads, and as many of them are graded they will form important auxiliary fire lines. Not all of the old rights of way are located so that they can be used as roads but all of them will be cleared of brush and other inflammable material and their having been built through the forest reserve will save the state

thousands of dollars in the construction of fire lines. Probably only a few new roads will have to be cut and these only from the railroads to the nurseries and camps to which it will be necessary to haul heavy supplies.

Trails.

The foresters and rangers will be mounted on strong and tough western horses so that they can cover their districts rapidly and get to fires with the least possible delay. However there is so much down timber, young growth and brush on most of the lands that it is practically impossible to travel advantageously on horseback in most directions unless plenty of good trails are built.

It should be remembered that these trails are not simply of value as bridlepaths, but will also be extremely valuable in the protection of the reserve as they will act as small fire lines and will check thousands of surface fires. The trails will also be built as far as possible so as to follow the ridges, as the rangers can then see much more of the country as they ride over the trails.

PROPOSED FOREST RANGER SCHOOL.

There is a growing danger in this country that the number of technically trained foresters who are being graduated in increasing numbers from the various forestry schools in the country will exceed the demand, for until lumber companies and timberland owners more generally adopt the principles of forestry in the management of their forests, the employment of foresters will be largely confined to government and state work. There is always a danger in the early periods of any new profession of overdoing it and also a strong temptation to cut down the instruction to as short a time as possible.

It is felt that Wisconsin should not start a forestry school as she can secure the foresters that will be needed from the well equipped schools at the Universities of Michigan and Minnesota. Through the establishment of the Forest Products Laboratory of the Forest Service at the University of Wisconsin, the University has an exceptional opportunity to train men in the best methods of utilizing all forms of forest waste. The university is now offering the first year's courses in this study and it will have a very large and growing field to cover in this line of work.

Wisconsin, however, needs a school for forest rangers, for the time has now come when the state requires the services of a number of well trained rangers and there are a large number of lumber companies and timberland owners who will be only too glad to secure men who not only understand the practical details of lumbering, cruising and surveying, but who have had training in forestry methods as well. Young, strong men who have worked in the woods should be given the preference and the school should be located at a camp in the forest reserve as all the instruction in woods work should be practical and given in the field. It may also be found necessary to give the men some instruction at the University in connection with the work of the College of Agriculture, but if they spend two summers in the forest reserves and one winter at the University they should be well fitted for their work.

It is recommended that the State Board of Forestry be authorized to establish a forest ranger school in co-operation with the University and that while on the forest reserves the men should be given their board and lodging in the camps and $1.50 per day for the time they are actually working for the state and not receiving instruction.

COUNTY FOREST RESERVES.

In nearly every county in the state there are areas that are not suitable for agriculture but that should be used for forests. Some counties contain only small tracts of such true forest land but in others such areas are very much larger and their proper utilization therefore becomes of great importance. It will be many years before the state can attempt the management of all such tracts and it is felt that in most cases it would be much better for the counties to own and manage their own forest reserves.

Up to as late as 1900, thousands of acres were yearly forfeited to the northern counties for non-payment of taxes, for the lumbermen in those days felt that when the timber was removed the land was of little if any value. The counties were anxious to get such lands back upon the tax rolls and therefore they auctioned them off and large tracts were sold for 20 to 25 cents per acre. If, however, the counties had retained all true forest land and protected the large amount of now valuable timber that was then left, they would now be receiving a very considerable revenue from such lands and could look forward to large future profits. At present very little land is being forfeited for non-payment of taxes and therefore the counties have largely lost the opportunity that they had a few years ago of acquiring lands for nothing.

The price of the agricultural land will advance as its value becomes better known, but the speculative holders of non-agricultural land will gradually let go of such holdings and the counties will then be able to acquire them at their true values. Communal forests are very common in Germany, Switzerland and other European countries and those that are well managed pay net annual revenues of from $2 to $9 per acre, the average probably being about $3. The result is that the citizens of many such communities are not obliged to pay taxes of any kind, the revenues from the forest being sufficient, and they also have the best possible schools and roads besides frequently receiving their fire wood free of cost. Many people will, doubtless, say that

this is too socialistic, but forestry from the very fact that it is a long time investment can be more successfully carried on by the state or county than by the individual. Many counties in northern Wisconsin could now acquire tracts of true forest land at a very reasonable price which in a few years would produce a handsome annual revenue that could be applied to reducing taxes or providing better roads and other local improvements. Those counties will secure the greatest permanent prosperity that develop every acre to its truest and highest usefulness, and therefore it is recommended that the counties be authorized by law to acquire forest reserves and that the State Board of Forestry, upon request, may co-operate with any county in the acquisition, protection and management of such reserves.

Director Johan Hirsch, formerly president of the National Agricultural College of Norway, makes the following statements in regard to the forests that are owned by the communes in Norway. (The commune is the smallest government subdivision, corresponding to our township system in Wisconsin.)

"Many of our communes buy timber lands. They receive assistance to do so from the state, which in most instances loans the district the necessary funds. Trysil commune has bought timber lands twice, first about ten years ago for about $70,000 and again last year for about $900,000. The first purchase has been paid for from the timber cut. On the tract last purchased there was cut last winter over $215,000 worth of timber and this winter a like quantity will be cut. It has plainly proved a profitable undertaking.

"This commune, Faaberg, bought last year 8,000 maal of timber lands (a little less than 2,000 acres) for which it paid about $21,000. This winter we will cut without any injury to the forest about $8,000 worth of timber. The commune of Vardal has bought timber land for about $688,000."

The "Skandinaven," Chicago, publishes a letter from its correspondent in the community of Trysil, dated November, 1910, which brings the condition of forestry in that district down to date. A translation of the article is as follows:

"Trysil commune was the first commune in this country that bought forests on a large scale. In 1891 it bought 100,000 maal from an English company. Originally this forest was sold off from different farms in Trysil. The commune paid about $53,000 for the timber. It was then appraised at about $60,000. Smaller parcels were added later.

"When the commune in 1906 made its last purchase, the timber lands first bought had not been paid for entirely from the timber cut. As these lands had to be mortgaged in connection with the latest purchase, an appraisal was made of the lands bought in 1891. This appraisal amounted to not less than $150,000, and even this was considered low by many men acquainted with local values. In 15 years, therefore, the forests had not only paid for themselves but increased in value nearly three times. It may easily be comprehended that Trysil was strongly in favor of new purchases in 1906. These new purchases had an area of 350,000 maal. The entire forest now controlled by the commune is thus between four and five thousand maal, or from one-fourth to one-fifth of the entire forest area contained in the commune. (A maal slightly exceeds four acres in area.) Before closing the deal the commune appraised the forest in question, which appraisal amounted to about $950,000, not including the land fit for agriculture. The purchase price was about $840,000.

"Lumbering has been going on in these forests for four years, resulting in a net profit of about $390,000, thus leaving the balance of the purchase price on June 30th of this year about $580,000. . . . Of the original loan in the Christiana Savings bank of $195,000 there now remain two payments of $50,000 with interest which will presumably be paid through the cut of 1910–1911. . . . The purchase of forests has been of great benefit to the community in many respects. The commune has been able to provide cheap lands to many new settlers, while the lumbering has been done by the people of the neighborhood, thus furnishing them steady work. It may also be mentioned that other work for the improvement of the forest has been undertaken. Thus ditches have been dug to the extent of 100,000 metres (in the neighborhood of 63 miles). This has been particularly fortunate for the laboring people in the summer time. . . .

"It may be stated also that the forests in the cut-over sections have not from the forester's standpoint been cut too closely, but rather the contrary. The sections cut over have on the whole yielded very good results compared with the appraisals."

FOREST FIRES IN 1909 AND 1910.

The forest fires of 1908 were the most extensive and destructive that had occurred for many years, burning over 1,000,000 acres and destroying merchantable timber and young growth valued at $9,000,000. In view of the widespread and lasting destruction of the forests the State Board of Forestry strongly recommended that a forest fire patrol system should be organized to prevent as far as possible the starting of forest fires. This recommendation was criticised in some quarters upon the ground that the board was advocating a system to meet unusual conditions and that such destructive fires as swept the northern portion of Wisconsin in 1908 would probably not occur again for many years. Such a delightfully easy way of doing practically nothing to check the fires and taking chances on the future was apparently endorsed in 1909, as the rains were frequent throughout the summer and only 166,000 acres were burned over with a total loss of $104,000. However, the long and dangerously dry weather during the summer of 1910 caused forest fires to start in all directions and as the year closes we find that 892,000 acres have been burned over with a loss of over $5,000,000.

A wise man, or a wise state, should not need to be taught the same severe lesson more than twice in the course of three years. What our pleasantly optimistic friends call "unusual" years occur only too frequently, but the real reason why the forest fires in northern Wisconsin are so much more destructive than in the past is because the hemlock and hardwood forests, which formerly checked the fires, are now being cut so heavily that their value as "fire breaks" is being rapidly destroyed and therefore the fires are much more extensive and destructive. The urgent need of a well organized forets fire patrol to prevent fires is fully explained in this report. Following are summaries of the forest fires in 1909 and 1910.

REPORT OF FOREST FIRES IN WISCONSIN FOR 1909.

Counties.	Fires since January 1.	Total number acres burned over.	Number acres merchantable timber burned over.	Number acres second growth burned over.	Number acres without timber burned over.	Merchantable timber destroyed (feet).	Value of timber destroyed.
Ashland	6	1,785	168	80	1,542	480,000	$1,440
Barron	3	1,020	.....	300	720	.....	.....
Bayfield	18	8,760	972	5,460	2,328	541,200	6,840
Burnett	14	11,170	300	2,270	8,600	105,000	275
Chippewa	16	460	220	120	120	.....	200
Clark	27	10,440	280	7,580	2,580	12,000	248
Douglas	6	870	.....	200	670	.....	.....
Dunn	2	1,015	.....	200	815	.....	.....
Dodge	5	6,000	.....	.....	6,000	.....	.....
Eau Claire	32	3,500	500	1,500	1,500	.....	.....
Florence	1	100	.....	.....	100	.....	.....
Forest	7	12,465	3,410	3,300	5,755	100,000	500
Iron	7	1,251	51	350	850	300,000	600
Jackson	32	34,340	100	4,540	29,700	100,000	200
Juneau	6	10,700	.....	4,100	6,600	.....	.....
Langlade	2	145	25	120	.....	10,000	600
Lincoln	15	1,529	373	599	557	572,000	1,104
Marathon	18	1,117	133	545	439	35,000	200
Marinette	22	3,526	400	771	2,355	25,000	1,625
Monroe	2	760	80	300	380	.....	300
Oconto	19	2,500	305	1,208	987	530,000	1,625
Oneida	13	3,298	207	1,305	1,786	135,000	650
Polk	3	2,445	1,000	300	1,145	.....	.....
Portage	18	2,726	142	580	2,004	130,000	860
Price	19	15,678	221	7,202	8,255	553,000	1,210
Rusk	10	309	20	10	279	100,000	200
Sawyer	.....	.....	.....	.....	.....	.....	.....
Shawano	3	4	.....	2	2	.....	.....
Taylor	17	395	7	120	268	9,900	121
Vilas	8	1,450	160	1,290	.....	400,000	2,400
Washburn	16	5,035	1,665	1,220	2,150	10,000	400
Waupaca	.....	.....	.....	.....	.....	.....	.....
Wood	45	21,958	340	2,250	19,368	20,000	200
Totals	412	166,751	11,074	47,622	107,855	4,168,100	$21,798

REPORT OF FOREST FIRES IN WISCONSIN FOR 1909—Continued.

	Value of young growth destroyed.	Total value of all forest products.	Value of improvements destroyed.	Value of live stock killed.	Number of men employed by towns in fighting fire.	Number of men employed by timber owners fighting fire.	Expense to towns for fighting fire, posting notices, etc.	Expense to timber owners for fighting fire.
					3	22	$58.50	$40.00
Ashland	$50	$1,678				8	7.00	20.00
Barron	500	500			135	10	384.83	10.00
Bayfield	8,400	10,240	$1,005.00		24	85	37.35	35.00
Burnett	590	3,140	90.00			40	39.20	125.00
Chippewa	150	525	180.00		108	62	295.75	100.50
Clark	33,915	35,168	1,700.00		46	36	76.20	2.00
Douglas					5	30	19.50	40.00
Dunn	100	100	50.00		5		5.00	
Dodge							38.70	
Eau Claire							11.50	
Florence		15			30	128	101.20	485.00
Forest	1,202	7,005			21	58	80.50	200.00
Iron	3,400	4,600			83	86	239.02	470.00
Jackson	8,100	8,380	1,050.00		69	43	298.82	35.00
Juneau	3,300	3,300	2,100.00				70.85	
Langlade	3,000	3,600			48		97.05	50.00
Lincoln	1,525	3,294	550.00	$150	51	22	87.15	23.00
Marathon	1,065	1,385	2,704.00	4 0	31	51	203.65	144.50
Marinette	2,250	4,035	2,300.00			20		
Monroe	200	500			10	13	87.25	65.00
Oconto	1,225	2,950	15.00		47	10	262.89	50.00
Oneida	140	1,870	100.00				23.00	
Polk	100	100	50.00		57	50	270.25	500.00
Portage	700	1,660	125.00	100	61	23	313.05	135.25
Price	340	2,125	175.00		28	11	64.55	20.00
Rusk	50	300					27.50	
Sawyer					7	40	87.75	50.00
Shawano	50	50	350.00		12	56	354.11	6.00
Taylor	116	492			8		100.00	
Vilas	1,000	3,400	36.50		58	9	18.80	50.00
Washburn	1,300	2,300					5.00	
Waupaca					250	132	387.80	137.00
Wood	1,100	1,300	1,068.00					
	$68,868	$104,012	$13,648.50	$710	1,197	995	$4,153.72	$2,613.25

REPORT OF FOREST FIRES IN WISCONSIN FOR 1910.

Counties.	Fires since January 1.	Acres burned over.	Amount of timber destroyed (feet).	Value of timber destroyed.	Value of young growth destroyed.	Total value of all forest products.	Expense to the counties.
Ashland	38	20,583	27,617,000	$82,851	$102,915	$185,766	$947.61
Barron	26	10,170	.....	.....	50,850	50,850	77.65
Bayfield	173	132,995	36,274,400	108,822	664,975	773,797	3,359.47
Burnett	52	82,160	250,000	1,600	410,800	412,400	1,225.21
Chippewa	20	6,610	682,000	4,800	33,050	37,850	182.94
Clark	34	19,520	.....	.....	97,600	97,600	140.70
Dodge	5	2,575	.....	.....	12,875	12,875	66.05
Douglas	67	71,996	9,400,000	33,000	359,980	392,980	4,304.67
Dunn	16	3,735	50,000	225	18,675	18,900	41.25
Eau Claire	8	200	.....	.....	1,000	1,000	43.91
Florence	11	1,080	103,600	525	5,400	5,925	117.60
Forest	42	7,263	2,170,000	12,000	36,315	48,315	2,405.90
Iron	31	42,700	4,101,800	22,000	213,500	235,500	1,344.17
Jackson	33	21,048	.....	.....	105,240	105,240	298.75
Juneau	4	3,900	.....	.....	19,500	19,500	31.80
Langlade	51	27,350	55,020,000	282,000	136,750	418,750	2,423.89
Lincoln	49	20,041	5,430,000	32,800	100,205	133,005	2,735.80
Marathon	61	26,581	2,596,000	13,000	132,905	145,905	1,750.43
Marinette	40	10,375	2,450,000	6,000	51,875	57,875	989.00
Monroe	1	.....	.....	.....	.....	.....	14.25
Oconto	43	11,115	10,070,000	58,000	55,575	113,575	1,173.46
Oneida	68	59,650	31,335,000	103,000	298,250	401,250	2,735.04
Polk	26	14,243	85,000	400	71,215	71,615	195.75
Portage	28	3,532	.....	.....	.....	.....	327.46
Price	69	66,397	2,330,000	113,800	331,985	445,785	5,683.01
Rusk	54	9,445	535,000	2,500	47,225	49,725	1,248.57
Sauk	2	2	.....	.....	.....	.....	26.37
Sawyer	34	62,980	4,700,000	20,000	314,650	334,650	1,474.69
Shawano	35	9,787	1,337,000	25,700	48,935	74,635	1,256.00
Taylor	52	29,703	5,730,000	32,000	148,515	180,515	3,398.84
Vilas	41	39,858	6,650,000	42,000	199,290	241,290	2,148.00
Washburn	47	55,040	.....	.....	275,200	275,200	194.85
Waupaca	9	162	.....	.....	810	810	.....
Wood	42	20,087	.....	.....	.....	.....	959.32
Totals	1,807	892,833	208,913,800	$997,023	$4,346,060	$5,343,083	$43,331.41

CAUSE OF FOREST FIRES.

1909.

Engines	15½ per cent.
Settlers clearing land	46 per cent
Hunters and campers	6¾ per cent
Miscellaneous	16¼ per cent
Unknown	15½ per cent
	100 per cent

CAUSE OF FOREST FIRES.

1910.

Engines	21½ per cent
Settlers clearing land	28½ per cent
Hunters and campers	5½ per cent
Miscellaneous	7½ per cent
Unknown	37 per cent
	100 per cent

RAILROADS AND FOREST FIRES.

As stated elsewhere in this report, our records show that from 1904 to 1908 railroad locomotives caused only about 5% of the forest fires in Wisconsin, while the settlers in burning brush and clearing land were responsible for from 60 to 70%. In 1908, however, the railroads were charged with 15% and this sudden rise was accounted for by the fact that so little rain fell during the summer months that the ground became like tinder and the least spark from a locomotive would start a blaze. The summer of 1910 was also very dry and in July and August the whole northern part of the state became so inflammable that the locomotives set hundreds of fires, many of which did an enormous amount of damage, and the reports of the fire wardens show that the number of railroad fires increased very largely over the record for the last few years, and that we must charge them in 1910 with 21%.

For over two years the State Board of Forestry has been working with the railroads in Wisconsin to prevent the starting of forest fires by locomotives. An engineer was appointed to inspect all the locomotives in use in the northern part of the state to determine if they were equipped with the most practicable netting to prevent the escape of sparks or cinders, as is provided by law. The inspector sometimes found holes in the front end nettings and ashpan nettings, and that the ashpan nettings are too light to stay down in place or hold their shape.

The nettings are not the most serious matter, however, but rather the holes around the steam pipes, stand pipe, blower, pump exhaust and around the edges of the smoke box and deflector plate. After more than a year of inspection work we found that such holes formed so rapidly that no amount of the closest and best inspection would solve the problem, but that the thing to do was to find a spark arrester that would absolutely prevent the escape of sparks and still allow the engine to steam freely and pull its load. Our engineer, therefore, set to work to experiment with various spark arresters and he finally designed one that

seemed to be a step in the right direction. The Chicago & North Western railroad made the castings in their Chicago shops and the arrester was thoroughly tried out on one of their freight engines. It proved to practically prevent the escape of all sparks, and the engine would steam freely and pull its full load provided the fireman fired frequently and evenly, but if he shoveled in a very large amount of coal at one time the engine would choke up and the steam guage would drop. It may be, however, that this difficulty can be overcome by a slight change in the arrester.

During the summer of 1910 the American Spark Arrester company of Indianapolis have been carrying on some extensive tests at Purdue university, and although their success so far is very encouraging, certain details remain to be perfected.

The Chicago & North Western railroad have worked out a head end arrangement which with a little improvement promises great results. The writer lately rode behind an engine equipped with this arrangement, which was hauling a time freight and steaming very freely and yet in a fifty-mile run only twenty-two sparks were seen to escape from the stack.

It is a comparatively simple matter to get an arrester that will stop a locomotive from throwing sparks, but very difficult to find one that will also allow the engine to steam freely and pull its load. However, so many railroad companies, and other interested parties are working to solve this problem, and the need for its solution is so great that success seems certain to come in time.

The following address of Mr. R. H. Aishton, Vive-President Chicago & North Western railroad, delivered at the Lake States' Conference at St. Paul, Minn., December 6, 1910, shows the direct financial interest of the railroads in this question.

Interests of Railways in the Protection of Forests.

I have been asked to prepare a paper on the interests of the railways in protecting forests. First, let us consider what are the interests of the railways in these three states represented in the conference, and through which these railways pass. In Minnesota there are, approximately, 33,400,000 acres of forest area; in Wisconsin, approximately, 20,300,000 acres of forest area, and in Michigan, approximately, 24,300,000, making a total in the three great states of 78,000,000 acres of forest that we are here to try to protect.

In Minnesota, located within the forest area alone, there are

2,000 miles of railway; in Wisconsin there are 2,300 miles, and in Michigan there are 3,200 miles, or in the three great states 7,500 miles, lying wholly within the forest area, and this does not include logging roads, double tracks, sidings, spurs or anything but main tracks.

In the operation of these railways, and used exclusively within this forested area, there are, in the state of Minnesota, in regular service, 350 locomotives; in Wisconsin, 450, and in Michigan, 530, or an approximate total of 1,330, employed regularly, and this does not take into account extra locomotives required for relief, shopping, or to meet emergencies or exigencies in business; and it is safe to say that to perform the service in the forested area in these states there are employed each year—at some period of the year or other—approximately 1,800 locomotives.

The magnitude of the traffic through these districts can probably be best indicated by the statements that in the forest area of Minnesota there are moving daily 126 passenger trains; in Wisconsin, 240, and in Michigan 230, or a total of 596 passenger trains daily moving through some part or other of this forest area.

There are also operated daily through this forest area, in Minnesota, 250 freight trains; in Wisconsin, 340, and in Michigan, 350, or a total of 940 freight trains daily, all of which move through this forest district.

Railroads as Consumers.

It is hardly necessary for me to call your attention to the fact that the railways are, and will be for years to come, the greatest single consumers of the products of this timber country, and furnish a ready market for the settlers, lumbermen, and for other interests, and they realize fully, I think, the benefits accruing to them through conservation of the remaining forest areas in these states lying right at their doors, and they also realize fully that for every dollar they pay for piling, posts, lumber or ties throughout this district a certain portion of it comes back to them necessarily through the cleaning up and cultivation of the country; the bringing in of an additional number of people who are capable of earning a livelihood, and for whom they must transport the necessaries of life, and to whom they must look for their support.

From another standpoint: Minnesota, northern Wisconsin and Michigan forest country is today the most attractive fishing,

hunting and summer resort territory left in this great country of ours and is tributary to the greatest centers of population in the country with the single exception of the Atlantic seaboard. The railways, more than anybody else, appreciate the possibilities of the proper conservation, care and development of these areas, and that where they now carry people by the hundreds to these resorts they will soon be carrying them by the thousands with resulting benefit both to themselves and to the communities residing within these districts.

Agricultural Interests.

We have heard a great deal lately about the cost of living. With the wiping out of the tie, post and lumber supply through this northern lumber country, the effect on the maintenance cost to the railways, about which we have heard so much in the rate hearings lately, would be particularly disastrous.

We all remember the day when the northern limit of agriculture was about at Green Bay, Wis. Today we find, bordering the lakes, successful agriculture carried on right up to and beyond Lake Superior, and where formerly the forest held sway we find today prosperous and contented settlers improving the land, raising crops and sustaining not only themselves but the large communities incident to that territory. Had this territory been deforested through fires, the ability to get settlers to go in there would have been limited as, in a great many cases, even the soil itself is destroyed or rendered unfertile through fires passing over it, and the ability therefore to develop agriculturally is gone.

The question now occurs, what, with all their varied interests in the prevention of forest fires, have the railways done to prevent them? I know what the general practice has been.

First. Maintenance of a clean right of way, free from brush, stumps and rubbish.

Second. Co-operation with the fire wardens in keeping the right of way thoroughly cleaned up and burned off.

Third. Absolutely prohibiting the setting of fires by sectionmen, or other employees, except during the winter months or under the direction or order of the fire warden.

Fourth. Installation of the very best and most approved netting in the front ends of locomotives, and constant investigation and experimenting into every new appliance that promises any

relief from fire. In connection with this a very thorough system of inspection at terminals and record of the condition of netting, and arrangements for repairs of same when defective.

Fifth. During particularly dry periods the abandonment of freight service during daylight hours.

Sixth. When dry conditions prevail the establishment of patrol either behind trains moving through the district, or at points in close proximity to each other, to guard against fires starting on the right of way and all times maintaining section patrols.

Seventh. By instructing train crews and engine crews on the importance of avoiding every possibility of setting fires, and directing them when fire is found on the right of way, to stop their trains wherever practical and put it out. Or in cases where their own, or any other train, would be endangered by such steps, by leaving word with the first agent or section crew and having them start back all the help possible to put out the fire.

What further can the railways do, I am very frank to say that I do not know.

They believe that the protection of the forests now conserves the revenues of the railways in the future, and to many of the railways it means their future life and prosperity.

They believe that the protection of the forests may be bettered by more efficient control by the officers of the states over all the interests engaged in business in the timber areas.

They believe in taxation that will enable a well-trained and efficient force to be organized and maintained in each state, and endowed with police powers, for the protection of the forests.

They believe the interests are so great and so identical that settlers, lumbermen, manufacturers and railways, and every other interest should unite in a plan to which all can work, which would be harmful to no interest but beneficial to all.

FIRE AND THE YOUNG FOREST.

It is a self evident fact that if any state expects to have forests in the future, it must see to it that the young forests of today are not destroyed, and yet it seems difficult to make the people of Wisconsin appreciate this very simple truth. One reason is that people have naturally felt that much of the cut-over land that was covered with young timber was suitable for farms, and as this was the best possible use for it, that it made no particular difference whether the young timber was burned this year or cleared off a few years later in making the farms. Such reasoning would be perfectly sound if all the cut-over lands were suitable for agriculture, and while on the whole most of them unquestionably are, still the aggregate of the lands that are too rocky or sandy to be fit for agriculture, is very large and it is a serious loss to the whole state, which it will take many years to repair, to permit the destruction of forests upon such lands.

This emphasizes the urgent need of completing the soil survey in northern Wisconsin as soon as possible, and the necessity for this is explained more fully under "Urgent Necessity for Completing the Soil Survey."

The best economic development of the state demands that each acre of land should be put to its truest use and neither the state nor the individual should keep forests on lands that are better suited for growing agricultural crops. The very existence of our wood-using industries depends upon the protection of our young, growing forests and there is no question but that Wisconsin will lose nearly all of its wood-using industries within the next twenty-five years unless the present destruction of our forests by fire is stopped. Such a statement will probably be challenged as exaggerated, but it is based upon a recent investigation of the forest resources of northern Wisconsin and the destruction of young growth by fire.

We are all more or les familiar with the plight of many towns and even cities, when suddenly the lumber industry, on which they largely depended, has come to an end. Many of these towns have established new industries and after a brave fight are slowly recovering, but the blow was a hard one and the results are more or less lasting.

The effect upon the state of losing its wood-using industries will be the same, but the calamity will be much more widespread

and will be felt much longer. Wisconsin is pre-eminently a lumber state and its magnificent network of rivers, with some 1,000,000 horse power in water powers which are well distributed, make it one of the most favored states for the manufacture of the raw products of the forests.

A forester is trained to a full appreciation of the value of young timber, for he is early taught the cost of growing timber and how long it requires to reach saw log size. On the other hand a person who has not studied the subject is apt to feel that a fire on cut-over land has done little if any real and lasting damage, as he reasons that there was no merchantable timber to be destroyed. The real situation is that the young growth that is left after the logging operations consists in most cases of a considerable proportion of valuable species which if protected would form as valuable a forest as that cut.

Instead of being protected it is burned over and on the burned ground there grows up popple and bird cherry with possibly some white birch, all three being very inferior species with almost no present market value and generally considered mere fire weeds. The direct result of the fire then is that a valuable young growth is replaced by almost worthless species, which it will cost a great deal to destroy and replace by planting.

Then too, looking only at the immediate financial loss, we find that upon the average the young growth that is left upon the land after logging operations is worth about $15 per acre. That is, it would cost that much to plant as many trees of the same kind and pay interest and taxes until they reached the same size. This puts the matter in a different light and it is safe to say that when stumpage is worth what it should be, namely, the cost of growing the timber, there will not be any indifference on the part of the owner to the destruction of his young forests.

Another point is that young timber when burned is soon blown over and forms a mass of inflammable material, which must be burned at very considerable expense if the land is to be planted, and the repeated burnings destroy most of the humus and thus the natural fertility in the soil.

It cannot be stated too often that although merchantable timber when burned can frequently be cut and thus a large part of the value saved, young growth that is burned over is almost always a total loss and the reclamation of such lands costs large sums. Also a surface fire in merchantable timber may scorch the trees and yet not kill them, but young timber is very sensitive to fire and even the slightest surface fire usually means their destruction.

LOPPING TOPS IN LUMBERING.

This is a protective measure the same as piling and burning slash, the object in both cases being to destroy a large amount of inflammable material as soon as possible. The following article in regard to the compulsory "lopping law" in New York state is taken from the American Lumberman of October 8, 1910:

Lopping Branches in Lumbering Operations.

Under this title in the fifteenth annual report of the New York Forest, Fish and Game Commission, Forester John W. Stephen makes an exceedingly interesting review of the first year's working of the New York statute which requires that the limbs and branches shall be lopped in all lumbering operations in coniferous timber in the forest preserve counties. The law reads:

> Every person who shall, within the forest preserve counties of the state, cut or cause to be cut, or allow to be cut any coniferous trees for sale or other purposes, shall cut off or lop or cause to be cut off or lopped from the said trees, at the time of cutting the said trees, all the limbs or branches thereof, unless the said trees be cut for sale and use with the branches thereon. Any person violating the provisions of this section shall be guilty of a misdemeanor and shall, upon conviction, be fined not more than twenty-five dollars or shall be imprisoned for not more than thirty days, or both, for each offence, and in addition thereto shall be liable to a penalty of two dollars for each and every coniferous tree felled from which he shall neglect to cut or lop off the branches.

This regulation is one of the protective measures adopted by the state for the safety of the timber in the forest preserve. No timber is cut on the preserve, consequently the regulation applies entirely to lumbering operations on private lands in the forest preserve counties.

A year is insufficient fully to determine the effectiveness of any regulation, but according to the report of Forester Stephen, who has carefully examined the results of lopping operations, the new law has so far been very satisfactory, as regards both cost and

efficiency. The requirement that the branches of coniferous timber shall be lopped, is based upon the assumption that if through lopping the unused upper part of the tree and the branches are brought in close contact with the ground they soon will decay and cease to become a serious fire menace, also that the decaying tops and branches protect young seedlings, increase the humus in the soil and add to soil fertility. Observation shows that under New York conditions this assumption is well founded. Ten years ago a spruce lumbering operation was carried on at Nehasane park. The tops were cut to a 10-inch diameter limit and the branches were lopped to reduce fire danger. Wherever the lopping was done thoroughly the tops have almost entirely disappeared and little material is left that will burn. On the other hand, wherever a top was not lopped it still remains supported above the ground by dry, hard branches and will be a source of fire danger for many years. The illustrations which accompany the report bring out these two conditions in most striking fashion.

Contrary to expectations the cost of lopping the branches, as required by the recent law, is not heavy. It is said that 3 cents a standard and 10 cents a cord of pulpwood is average cost under ordinary circumstances, if the lopping is done to the best advantage. In a number of cases lopping has resulted in actual gain to the lumbermen. Where branches are lopped, skidding and road making are facilitated greatly. Lopping also leads to closer utilization of timber, especially when pulpwood is taken out. One operator reports that through the decreased labor required in skidding, and the occasional logs saved, he believes that the actual cost of lopping does not exceed 5 cents a thousand feet of timber. Another operator who cut spruce saw logs did still better. The report says:

> He left the lopping until after the logs were removed and then went through lopping the branches and taking the timber out of the tops for pulpwood. In this operation, with a force of eight men and a horse employed six days, ninety-seven cords of pulpwood were obtained that would bring him $7 a cord delivered at the mill. This is an average of two cords a man a day, making a very profitable operation.

The Adirondack patrolmen have found also that fires are much easier to handle in lopped timber, because such fires are closer to the ground and men can get near enough to fight them more effectively.

The present New York law requires that only the branches of coniferous timber shall be lopped, since softwood slash is assumed to be the more dangerous. The indications are, however, that a similar requirement for hardwoods would give good results. Hardwood slash is less durable than softwood slash, and if lopped it would decay in a few years. This is made evident by the condition of the land which has been cut over to obtain wood for the acid plants in New York. These plants take small sized wood so that the remaining slash lies close to the ground and is left in good condition to decay. It is said that three or four years after cutting of acid wood the fire danger is nearly over with. In the cutting of hardwood saw timber there is nearly as much need for lopping the branches as in softwoods.

In conclusion the report sums up the case for lopping branches as follows:

> First—Danger from fire is probably lessened from the first by the form in which the brush is left, easier to clear away and not high in the air where it will throw sparks and start crown fires. At any rate, the lopped brush lying close to the ground rots very much faster than unlopped tops. In a few years it is incorporated with the soil and then ceases to be fuel for fire.
>
> Second—As a rule, it would appear that in the Adirondack forests reproduction is promoted.
>
> Third—In most operations some wood is saved that would otherwise go to waste. In some cases it has far more than paid for the cost of the work.
>
> Fourth—The labor of guttering and skidding is lessened to some extent.
>
> Fifth—It is to be noted that hardwood tops decay much faster than softwoods, also that the closer the utilization of timber the shorter the time required for the debris to disappear. Thus, in the case of hardwood operations for acid or cordwood, the debris left is of such small size and gets down so close to the ground that special fire danger is pretty well over in three or four years.
>
> The results of one year's operation under the present law are such that it certainly should be retained.

The above dispassionate and careful report should be of much value to lumbermen in the lake states at the present time, where

the heavy fire losses of this year and the much greater losses of two years ago have made it evident that thorough going measures of fire prevention and control must be adopted. The burning of pine slash is said to have worked fairly well in Minnesota, but a proposed compulsory burning of hardwood slash in Wisconsin two years ago aroused so much opposition from the lumbermen because of its cost and possible inefficiency that a similar measure is not likely to be proposed again. Timber in the lake states and New York is of much the same character. Moisture conditions are also similar. If lopping the branches proves to be a cheap and effective aid to forest fire control in New York the same method should be given a thorough trial in Michigan, Wisconsin and Minnesota.

In reference to the above article it should be said that the burning of pine slash upon the National forest in Minnesota and the Indian reservations in both Minnesota and Wisconsin has worked extremely well and the cost upon the average has not exceeded twenty-five cents per thousand feet of logs cut. The Forest Service, also, compels the piling and burning of slash upon most of the National forests in the west and it has proved a most effective method of forest protection. Pine slash can easily, and should nearly always, be burned as the cutting proceeds, the smaller limbs and all branches simply being thrown on the fire. If the forest is mixed pine and hardwoods, the pine slash makes a very hot fire and the smaller hardwood limbs and branches will be readily consumed, but if the forest is only hardwood, and material to start hot fires is lacking, the hardwood brush must be piled and left to dry out before it can be burned.

Many lumbermen have a mistaken idea and think that the foresters wish to compel them by law to burn all that portion of the tree that is left in the woods. This is not true as it is not at all necessary in most cases to burn the big trunk or bole of the tree that is left in the top, but merely the smaller limbs and branches, which are highly inflammable when thoroughly dry.

The lumbermen of the Lake states are opposed to any general slash burning law but are willing to allow state commissions to say when and where slash is so dangerous that it becomes a public menace and must be destroyed. Lumbermen in order to protect their property, especially the young timber on their cut-over lands, and the property of others, should either burn their slash or lop it so that it will decay rapidly, for when forest fires get started in a heavy slash an army of men is almost powerless.

APPRAISAL AND CLASSIFICATION OF FOREST RESERVE LANDS TO BE SOLD.

Chapter 264, Laws 1905, which is the present forestry law, provides that all state lands north of town 33 shall constitute the forest reserve, but that scattering and agricultural lands may be sold and that the proceeds of such sales shall go into the "Forest Reserve Fund" and that this fund shall be used to purchase lands to add to the forest reserve, and for their improvement and protection. The object of the law was to dispose of the agricultural lands so that farms could be made, to sell the small tracts of isolated lands, which were badly scattered through seventeen of the northern counties, and to use the proceeds to purchase lands suitable for forestry, mainly in Oneida, Vilas and Iron counties, so as to block up the reserves in that section and thus make forestry management possible. This law is a most excellent one and without direct appropriations from the treasury has given the State Board of Forestry funds with which to start the work of building up an adequate forest reserve.

The old appraisals of state lands in many cases were found upon examination in the field to be so inaccurate, and the old prices both for land and timber were often so low as compared with prevailing prices that it was absolutely necessary to have all the lands that it was intended to sell examined and appraised by cruisers. It has taken a long time and hard work to examine and appraise all the lands to be sold, but the resulting increases in appraisals and closer classification has proved that this work had to be done and that the expense was amply justified.

The cruisers reports are very complete and are on each forty separately, showing the amount of timber of each kind, and its stumpage value, the character of the land, whether rolling, hilly or flat, and if stony; the soil is shown as loam, clay, sand or more definitely described if necessary; if swampy, whether it can be drained, also character and amount of young growth. If the description is a lot and adjoins a river or lake, this is of course shown on the plat and if the cruiser finds that there has been any

fire or timber trespass, the amount of the timber thus lost or destroyed is scaled and full notes made so that the trespass can be collected or burned timber sold.

During 1910 all the state lands within the following counties were offered for sale:

Ashland	Polk
Bayfield	Price
Burnett	Rusk
Florence	Sawyer
Langlade	Washburn
Lincoln	

Also, all the lands in Douglas county were offered for sale, except those along the Brule river where the state has a small forest reserve, and in Price and Iron counties all except those within the main forest reserve area. None of the lands in Forest, Oneida or Vilas counties are for sale. The state lands that are for sale have now been examined and appraised in all the counties except Marinette and it is expected that this work will be done during the summer of 1911.

LANDS THAT ARE FOR SALE.

As is fully explained elsewhere in this report, the State Board of Forestry is authorized to sell the scattering and agricultural lands noth of town 33, the proceeds of such sales to be used in extending the area of the permanent forest reserves and in their protection and improvement. All of the lands that it proved advisable to sell, with the exception of some tracts in Marinette county, have been examined, appraised and offered for sale at public auction, as provided by law, and those that remain can now be purchased through the State Land Office at Madison. The following table shows approximately the amount of land on the market north of town 33, that remained unsold on January 1, 1911:

County	Acres.	Langlade	2,300
Ashland	5,377	Lincoln	2,463
Bayfield	3,183	Polk	1,961
Burnett	19,012	Price	19,112
Douglas	2,645	Rusk	2,643
Florence	3,563	Sawyer	13,450
Iron	2,280	Washburn	9,009

Many of the above lands are suitable for agriculture and in fixing the appraisal of each forty, the value of the land and of the timber was figured separately. Those who are desirous of purchasing lands in any of these counties can secure lists showing the appraised value of each forty of state land, and a detailed statement showing the character of the land and the amount of timber of each kind can be supplied for any specified description.

Each forty has been carefully cruised, proper deductions being made for any timber that has been cut or damaged by fire and it it felt that the appraisals are fair and reasonable. Under the law the full amount of the appraisal must be paid at the time of sale, and 50 cents should be added to cover the cost of the patent fee, for each section in which one or more descriptions are purchased. Requests for information in regard to these lands should be addressed to the State Board of Forestry, Madison, Wis.

LANDS PURCHASED AND SOLD.

	Acreage Jan. 1, 1909.	Acreage Sold.	Acreage Purchased.	Acreage Reverted to State.	Acreage Jan. 1, 1911.
Ashland	6,258.97	935.92	.....	78.15	5,401.20
Bayfield	5,543.32	2,382.11	.....	.....	3,161.21
Burnett	21,566.75	2,612.79	.....	120.	19,073.96
Douglas	9,995.66	520.	.....	.....	9,475.66
Florence	3,802.86	243.70	.....	.....	3,559.16
Forest	35,427.34	.....	.....	.....	35,427.34
Iron	29,575.34	2,794.97	3,119.69	.....	29,910.06
Langlade	2,740.29	440.89	.....	.....	2,299.40
Lincoln	4,742.21	2,265.35	.....	1.	2,477.86
Marinette	4,534.21	40.	.....	.....	4,494.21
Oneida	53,030.63	.....	280.	.....	53,310.63
Polk	2,120.74	160.	.....	.....	1,960.74
Price	29,450.12	2,042.02	.....	66.35	27,474.45
Rusk	3,362.87	468.40	.....	.....	2,894.47
Sawyer	14,209.65	650.51	.....	.....	13,559.14
Vilas	36,171.36	.....	23,784.69	.....	59,956.05
Washburn	12,051.77	3,063.47	.....	.....	8,988.30
Total	274,603.09	18,620.13	27,184.38	265.50	283,423.84

Note.—The above table does not include the state lands within the Indian Reservations.

TIMBER TRESPASS.

The government and state practically encouraged timber trespass upon public lands for so many years by allowing trespassers to settle by simply paying the value of the timber taken, that it has been very difficult to stop the practice at once and to make such people understand that illegal cutting of timber is nothing more nor less than common stealing.

In 1905 the law was strengthened so that the civil liability for forest trespass is now double the amount of damages suffered and under criminal action the fine is not less than $25, nor more than $1,000, or imprisonment not less than fifteen days nor more than three years, or both fine and imprisonment. The result of this law has been to largely put a stop to all forms of trespass upon state lands, as it does not pay to cut timber illegally when one is obliged to pay double the value of the timber taken, plus all the costs of examination and survey.

Public opinion in northern Wisconsin, however, has not yet been educated to support a jail sentence for a trespasser, unless in the case of an old offender and when the trespass has been glaringly flagrant and willful. This is especially true in the case of a poor man with a family, as the jury seems to reason that if the man is sent to jail, his family will become a charge upon the county or town. After years of "rubber forties" and practical encouragement, the law cannot suddenly be made too drastic and still meet with public support.

However, the double stumpage law has been in operation for over five years, and it is now recommended that it is time to still further strengthen this law. The law of New York state provides a penalty of $10 for every tree cut on state lands but so drastic a law in Wisconsin at the present time would probably defeat its own ends. It is recommended that the civil liability for timber trespass be increased from double to triple the value of the timber taken, plus all the costs of examination and survey. Both the state and private timberland owners have been put to considerable trouble and loss in past years by Christmas tree trespass. Large firms in Chicago, Milwaukee, St. Paul and other

nearby cities make contracts with small jobbers or settlers to furnish a large number of Christmas trees. These contractors have been in the habit of going upon any land where there was a fine growth of young pine and cutting it all off in a few days' time. Many such trespassers are not residents of Wisconsin and they can cut, load and ship these small trees so rapidly that it is very difficult to detect them until the trees have been shipped and then the offenders are outside the jurisdiction of the state. However, timberland owners have dealt with such cases as severely as possible by imposing heavy fines, confiscating the trees cut and also bringing criminal action, so that this business is being largely discouraged and the dealers are compelled to buy the young trees from those who are willing to have them cut. The state has only suffered to a slight extent from such operators, as our lands are watched closely as Christmas approaches and we have been able to detect nearly all such cutting in time. The children and grown-ups need not fear that there will be any shortage of Christmas trees in the future or that foresters will discourage this old custom.

Upon lands that are protected from fire thousands of young pines will come up to the acre, and if left to themselves to follow out nature's law there will be a fierce struggle for existence, so that only a small percentage will survive. These will be the strongest and best developed but by far the greater number will gradually die and fall to the ground. Even the strongest young trees that survive are checked in their growth during the years of their fiercest struggle for existence and the forester can aid nature by cutting out the less promising trees and thereby allowing the stronger to shoot ahead free from the struggle.

Such cuttings are called "improvement thinnings" and are an important part of forestry work in all foreign countries where there is a ready market for the young trees that are thinned out.

In this country the forester as a rule has not been able to make improvement thinnings as there has been no market for such young trees, but the demand for Christmas trees promises to furnish the market to a considerable extent and therefore the forester hopes that more Christmas trees will be used and not less. However, he wants such young trees cut out under a system that will hasten the rate of growth and improve the future forest and does not want to have every tree cut by a person who is politely called a trespasser while in fact he is nothing less than a common thief.

TIMBER SALES.

The very severe and widespread forest fires of 1908 and 1910 killed a considerable amount of timber upon the scattering forest reserve lands, especially in the western part of the state. It has been impossible to protect all the forest reserve lands, as they comprise approximately 340,000 acres, and are scattered through 17 counties. Such losses will continue until the forest patrol system is established and the main reserves are blocked up and protected by means of fire lines, roads, trails, telephones, etc., and a well organized force of forest rangers. The burned timber is advertised for sale in the local papers, to the highest bidder shortly after the fires have occurred and the tracts have been looked over by one of our cruisers.

Frequently the timber is thus sold at once, but sometimes the bids are too low to be considered and the timber must be held until a favorable bid is received. Nearly all of the burned timber has been disposed of but some of it is so remote that no sales can be made and in such cases the timber will probably be a total loss.

This brings up a point that many of the lumber journals of the country seem to overlook. They frequently state in mentioning fires in various parts of the country that the loss in timber will be practically nothing, as the lumbermen will cut the timber and thus save it. True the lumber company owning a fairly solid body of timber, with a railroad to promptly haul the burned timber and a mill to cut it, can save much, although fires nearly always increase the cost of operation, and the fires of 1908 and 1910 have thrown a lot of lumber on a market that was already rather sick from overproduction.

But what of the scattered forties that the lumber companies own and the thousands of small tracts of from 40 acres to 600 acres, owned by settlers or men in the various cities and towns? Such owners, and their holdings are very large in the aggregate, are nearly always non-operators, and if they are fortunate enough to sell their burned timber at all, it is always at a big discount

from stumpage prices for green timber, and hence at a great loss, and much of such timber cannot be sold before it spoils and so is a total loss.

This greatly mistaken idea of some people that all burned timber is cut and saved is mentioned because such articles appearing in the lumber journals lead the general public, who are not posted in the matter, to naturally feel that the agitation in regard to the fearful economic losses from forest fires is all bosh and buncombe if the timber is cut and saved, and that there is no loss.

The apparently stoical indifference of the American people as a whole to forest fires is a blot on our civilization and to tell them there is no loss is a strange way to bring about reform and gain their active assistance in the hard work that must be done to stop the fearful destruction of our forests by fire.

REPORT

OF THE

STATE FORESTER

OF WISCONSIN

For 1911 and 1912

MADISON
DEMOCRAT PRINTING CO., STATE PRINTER
1913

ERRATA.

Page 21. The west boundary line recommended for the permanent forest reserve should be as follows, from the northeast corner of section 13 in T. 44, R. 4 E.: "thence south on the east line of R. 4 E. to the northeast corner of T. 43, R. 4 E.; thence west to the northwest corner of T. 43, R. 4 E.; thence south to the northwest corner of T. 41, R. 4 E.; thence west to the northwest corner of T. 41, R. 2 E.; thence south to the southwest corner of T. 41, R. 2 E."

The townships excepted from the permanent forest reserve should include: T. 41, R. 10 E.

Page 76. The third paragraph should read: "As the Federal patrolmen received $4,431.25 in 1911, and $4,238.50 in 1912, the cost of protecting the 1,000,000 acres of privately owned lands has been less than ½ cent per acre per annum."

Page 100. Last paragraph, first line, should read: "The price received for all lands sold averages $3.35 per acre."

Page 102. Lines 6, 7 and 8 should read:

Total acres owned by the State, north of town 33	342,704.43
Total amount invested therein	$553,729.39
Average amount invested per acre	$1.61

CATHEDRAL POINT, TROUT LAKE, VILAS COUNTY. A PORTION OF THE FOREST RESERVE.

REPORT

OF THE

STATE FORESTER

OF WISCONSIN

For 1911 and 1912

MADISON
DEMOCRAT PRINTING CO., STATE PRINTER
1913

STATE BOARD OF FORESTRY.

MEMBERS OF THE BOARD.

CHARLES RICHARD VAN HISE, CHAIRMAN,
President University of Wisconsin.

H. L. RUSSELL,
Dean State Agricultural College.

EDWARD ASAHEL BIRGE,
Director State Geological Survey.

L. H. BANCROFT,
Attorney-General.

GEORGE BEYER,
Oconto.

EDWARD MERRIAM GRIFFITH,
State Forester.

FRANK B. MOODY,
Assistant State Forester.

M. A. CASTLE,
Clerk.

A. V. CRANE,
Stenographer.

PETER JACOBS,
Head Cruiser, Minocqua.

E. M. WEAVER,
Head Ranger, Woodruff.

JOS. LUCIUS,
Locomotive Inspector, Rhinelander.

H. A. JOHNSON,
Cruiser, Tomahawk.

W. D. BARNARD,
Forestry Assistant, Woodruff.

P. C. CHRISTENSEN,
Forest Ranger, Tomahawk Lake.

J. B. COOK,
Forest Ranger, Star Lake.

A. E. DOOLITTLE,
Forest Ranger, Woodruff.

HENRY FREUND,
Forest Ranger, Boulder Junction.

J. H. KRUMM,
Forest Ranger, North Crandon.

FRANK J. LONG,
Forest Ranger, Sayner.

J. J. McDONALD,
Forest Ranger, Minocqua.

P. A. McDONALD,
Forest Ranger, Boulder Junction.

F. G. WILSON,
Forest Ranger, Woodruff.

CONTENTS.

OFFICE OF THE STATE FORESTER,

MADISON, WIS., Dec. 31, 1912.

State Board of Forestry.

GENTLEMEN: I have the honor to submit herewith my report for 1911 and 1912.

Very respectfully,

E. M. GRIFFITH,

State Forester.

REPORT OF THE STATE FORESTER.

FORESTRY PROBLEMS ON STATE LANDS.

History of Forestry Legislation.

As early as 1867 a law was passed in Wisconsin providing for the appointment of three commissioners to investigate and report upon the injurious effects of clearing the land of forests, the duty of the state in regard to the matter, and the experiments that should be made toward the growth and proper management of forest trees. An exhaustive and very valuable report was completed and published the same year by the commissioners, I. A. Lapham, J. G. Knapp and H. Croker.

In 1897 another law was passed providing for the appointment of a forestry commission of three members by the governor, who were to draw up a plan for the protection and utilization of the forest resources of the state, and for the organization of a forestry department and the creation of a forest reserve. The members appointed were George B. Burrows, H. C. Putnam, and Ernest Bruncken and their report was made and published in 1898, and it included a draft of a bill recommended for passage. However, no legislation resulted until 1903.

The first forestry commission, which was in existence before the forests of the state had been enormously depleted by lumbering, suggested the regulation of timber cutting, in order to prevent public calamity, deplored the ruthless devastation of large tracts of land by nonresident lumbermen, and advocated experiments in tree culture and investigation of the value of various species. The second commission, appointed after thirty years more of heavy lumbering operations had taken place in the state, advocated the immediate establishment of a system of

state forests, "not only for the protection of the climate and waterflow of the state, but for the purpose of providing a sufficient supply of raw material to the various lumber and wood industries" and outlined a plan for the organization of a department to carry out this work.

The forestry law that was finally passed in 1903, chapter 450, was essentially the same as the bill recommended by the forestry commission of 1897. It created an unsalaried forest commission composed of the attorney-general, secretary of state and state treasurer, ex officio, and of two others to be appointed by the governor, and provided for a superintendent of forests who was also to be state fire warden and as such to appoint town fire wardens. This law was intended to stop the sale of state lands so that they should constitute the nucleus of a state forest reserve but there were conflicting sections and the law also provided for the sale of the lands and such sales were made after the passage of the law. The attorney-general could not construe the law, it was so loosely drawn, and the state officers who then were members of the forest commission were obliged to place such high valuations upon the lands that they would not readily sell, in order to save any considerable acreage for forest reserve purposes. The law provided for the establishment of one or more forest experiment stations and a detailed inquiry into the character and condition of each parcel of land contained in the forest reserve, but it made an appropriation of only $3,000 annually besides the salary of the superintendent of forests and none of the money received from the sale of lands or dead and down timber was to go into a forest reserve fund. Under this law in February, 1904, a technically trained forester was appointed superintendent of forests, who has directed the work down to the present time. The land commissioners set aside in 1904 as the nucleus of a permanent forest reserve, 40,000 acres of state land in Oneida and Vilas counties, and again in the same year 22,000 acres in Iron county. Thus was real forestry work begun.

In 1905, a much more effective forestry law was passed, chapter 264. A state board of forestry was created in place of the former forest commission, and as it was made up of the president of the state university, the director of the state geological survey, the dean of the state agricultural college, the attorney-

general and one member appointed by the governor, the membership of the board was much less liable to change and a uniform non-political forest policy could be counted upon. The state forester was given an assistant and a clerk as well as authority to employ the necessary assistance for the improvement and protection of the forest reserve. All state lands north of town 33 except school lands were set aside for forestry purposes and those that were not suitable for permanent forest reserve lands because of their isolation or greater value for agriculture, could be sold upon the recommendation of the state board of forestry, and the funds so acquired could be used to purchase other lands suitable for the permanent forest reserve. Moreover, all money received from the sale of forest reserve lands or products from them was to constitute a forest reserve fund and the annual appropriation was increased to $9,800. The system of town fire wardens remained practically the same. Railroads and individuals operating engines of various kinds were made to take precautions against the setting of fires in forest or marsh lands and were made more specifically liable for fires caused by them.

In 1907, a law known as chapter 491 was passed, which appropriated ten thousand dollars per annum for acquiring lands as additions to the forest reserve by purchase at tax sales or by purchase from counties that had acquired lands under tax deeds. This law was amended at the following session of the legislature so that other lands than tax title lands could be purchased by the public land commissioners for the same purpose. In 1907, chapter 592, also, was passed, exempting from taxation for a period of 30 years not to exceed 40 acres of land planted to forest trees. Although this law was given publicity, no landowner has ever taken advantage of it, probably on account of the mistaken feeling that the initial cost of planting would be high. Chapter 335 authorized the Wisconsin Valley Improvement Company to build dams and create storage reservoirs along a certain portion of the Wisconsin river, so as to produce a more uniform stream flow. The creation of reservoirs is under the supervision of the State Board of Forestry and the financial operations of the company are under the supervision of the railroad rate commission, that is, the regulation of toll rates and so forth.

There are some 47,000 acres of land within five Indian reservations in Wisconsin that are claimed by the state under the Swamp Land grant. A law looking to the settlement of the State's claim, chapter 96, was passed in 1907, authorizing the State Board of Forestry in their discretion to have these lands appraised and to convey the state's interest in and title to such lands to the United States upon the payment to the state of the amount of the appraisal. A bill is now pending in Congress providing for supplementary action by the government in regard to the state's claim. The land in the Lac du Flambeau and Lac Courte Oreille reservations is not suitable for agriculture and the same is true to a considerable extent of the land in the Menominee and La Pointe reservations. The state should make an effort to have the government establish permanent forest reserves on the nonagricultural lands in the La Pointe, Lac Courte Oreille and Menominee reservations and it is particularly to be desired that there be a forest reserve on the Lac du Flambeau reservation as it is surrounded by state forest reserve lands and there should be coöperative management of the state and federal forest reserves.

In 1909, three laws were passed, worthy of note. In chapter 374, the state reserved to itself in all future sales of state lands, all mineral and water power rights; town boards were authorized to acquire tracts of land to be used and maintained as town woodlots in chapter 77; and by chapter 119 the State Board of Forestry was authorized to inspect all locomotives operated in forest or grass land to see that they were properly equipped to prevent the escape of sparks, and was also authorized to direct railway corporations to patrol their tracks during a dangerously dry time.

In 1911, several forestry laws were enacted. Chapter 601 entirely changed the organization of the town fire wardens system. Instead of the appointment of one or more fire wardens as needed, for any town, by the State Forester, every town chairman is made, ex officio, town fire warden, and the superintendents of highways are made assistant town fire wardens. Many towns have no superintendents of highways, as they prefer to have their road work done under contract. Therefore, some towns have one warden and some have as many as 24 or 25. Moreover, the towns that have the larger number of road sup-

erintendents are those that are thickly settled and therefore have little or no timber. Thus we have large numbers of fire wardens in towns where they are little needed and very few in timbered, unsettled townships where fire protection is much needed. Moreover, local fire wardens may change with every annual town election and it is a difficult matter for the State Forester, who is also State Fire Warden, to keep an accurate record of a large number of ever changing fire wardens, and to prepare them for their duties by giving them necessary information and to supply them with warning notices, report blanks and pamphlets without great waste. The State Forester may appoint needed fire wardens temporarily on recommendation of a town chairman, in cases of emergency. He is also given authority to mass such fire warden force as may be available at any special point to suppress fires but the law makes no provision for meeting the expense incident to the exercise of such authority. The expense of preventing or extinguishing running fires by town or assistant town fire wardens or those called into service by them is to be borne by the road district or districts within which the expense was incurred, and paid from the town treasury. Payment for services performed by fire wardens appointed by the State Forester is made, one-half by the county where such services are performed and one-half by the state. The town boards are given the authority to forbid the setting of fires during a dangerously dry time. Although this law may be in many respects an improvement over preceding laws, it could be very greatly improved.

Chapter 245 makes every railroad corporation owning or operating a railroad in the state responsible for all damage to property by fire communicated directly or indirectly by locomotive engines or by fire set to clear their rights of way. A property owner who suffers damage has only to give notice of his loss and proof that the fire originated from the railway, to any officer, or station agent or ticket agent, and if the loss is not made good in 60 days, the corporation is liable for double the amount of damage in an action in court. If the corporation offers a fixed sum that is refused and a court fails to sustain the property owner's claim for larger damages, the owner recovers only his damages and the railroad recovers its costs.

Chapter 494 strengthened a law already in existence in regard to locomotives, by giving any inspector designated by the State Board of Forestry the power to order out of service immediately any locomotive or engine not properly equipped with fire protective devices until such locomotive or engine has been properly equipped. In case of disagreement between any inspector and any railroad as to the adequacy of fire protective equipment of engines or locomotives, an appeal can be made to the railroad rate commission for a decision and they are to determine the matter.

Chapter 638 reënacted the general forestry law with a few changes. The State Board of Forestry was given the power to exchange lands, so as to facilitate blocking up the permanent forest reserves and the annual appropriation was increased to $35,000 as the work in the field had developed to such an extent that a much larger force of assistants was necessary.

Until 1911 there had been no appropriation for the purchase of forest reserve lands (except the $10,000 appropriation for tax title and other lands), the fund for such purpose being derived almost entirely from the sale of the state lands north of town 33 that were not suitable for forestry purposes. Chapter 639 appropriated annually for five years $50,000 to constitute a forestry investment fund, authorized the State Forester to enter into contracts for the purchase of lands and provided for the condemnation of lands needed for forestry purposes. This law also provided for a forest reserve committee of the legislature consisting of two senators and three assemblymen to be appointed during each session and to investigate and report before the end of such session upon purchases of forest reserve lands made since the preceding legislative session, and also upon prospective purchases.

Chapter 640 authorized the Chippewa and Flambeau Improvement Company to construct and operate storage reservoirs upon certain portions of the Chippewa and Flambeau rivers for the purpose of producing a uniform stream flow.

What Has Been Accomplished In Forestry.

The first work undertaken by the Forestry department was the creation of a permanent forest reserve. An investigation that had been made before any state lands were set aside had

shown that that part of the state lying in Forest, Oneida and Vilas counties, and in the eastern portion of Iron and Price counties was unquestionably the region to select, as it contains a very large number of lakes which are the headwaters of our important rivers, and as the greater part of the land is too sandy, rocky or swampy to be suitable for agriculture. It is very doubtful if there is another region in the United States where there are so many lakes within an equal area and where so many important rivers have their source.

The three main objects of forestry in this state are, first, to maintain forests on the headwaters of our important rivers, so as to keep the stream flow uniform; second, to provide raw material for our wood-using industries; and third, to make an attractive resort region. As Wisconsin has not, so far as is known, any deposits of coal, it is very important that her large number of well-distributed water powers, which are her only source of manufacturing energy, be made the most of. To this end a uniform stream flow should be secured by the use of our numerous lakes as natural storage reservoirs, the creation of artificial storage reservoirs and the maintenance of forested watersheds. The wood-using industries of Wisconsin are exceedingly important but the time has come when they are purchasing fifty per cent of their raw material outside of the state. The state should make an effort to retain these industries by providing a supply of raw material. The state has a resort region of wonderful natural attractions, the numerous lakes and streams and the forests with their fish and game bringing tourists from long distances. The proper protection and development of this lake region will bring a large income to the local residents and to the state as well. The summer resort business in northern New York state amounts to approximately $10,000,000 a year, this amount being paid by the tourists in railroad fares, to hotels and boarding houses, and for guides, teams, boats, etc. New Hampshire does nearly as well and Maine receives nearly $20,000,000 a year from her summer business.

The first land set aside for a forest reserve was 40,000 acres in Oneida and Vilas counties, in 1904. A little later 22,000 acres were added, in Iron county. The next year the Forestry department secured the law granting to it all state lands north

of town 33, which increased the acreage to 233,364. Most of the lands in the last grant were scattered over the entire northern portion of Wisconsin and it was necessary to have them examined and appraised and put upon the market, a few counties at a time, so as to obtain funds to buy other lands to block up the permanent forest reserves. This has been a work of years but it has progressed steadily, ten or twelve land cruisers having been employed at various times. Many thousand acres of scattering and agricultural lands have been sold and yet the acreage of forest reserve lands has increased through the purchases made within the permanent forest reserve area. Mr. Frederick Weyerhaeuser of the Nebagamon Lumber Company gave to the state some 4,000 acres on the Brule river in Douglas county and a small permanent reserve has been established there. The Federal government as a result of efforts on the part of Senator La Follette and the Forestry department granted 20,000 acres of government lands to the state, and many purchases of land have been made from the forestry funds, so that the present acreage of forest reserve lands is approximately 400,000 acres and purchases now pending will increase this area to about 410,000 acres.

The forest reserves have not only been increased in area and blocked up more solidly, but many improvements have been made. The headquarters for the field force has been established at Big Trout lake and a large Headquarters Camp building has been erected there, also a stable, ice house and boathouse. Five ranger cabins have been built at various points on the reserve and at least seven more will be constructed. The main forest nursery has been established near the Headquarters Camp and it now contains about 2,500,000 seedlings. Twelve forest rangers have been employed by the state and, by a coöperative arrangement with the United States Forest Service, the latter has employed twelve patrolmen within the state. As the past two seasons were rainy and the danger from fire slight, these rangers and patrolmen have been able, with the help of laborers working under them, to clear about 160 miles of old railroad grades so as to make both good roads and excellent fire lines, to cut about 118 miles of fire lines through the forests, to construct over 56 miles of telephone lines and to destroy dangerous slashings on about 1200 acres. These fire lines and roads have been made

so as to connect lake with lake and thus divide the forest reserve into compartments.

Four steel lookout towers, fifty-five feet high, have been erected on high hills within the forest reserve region. These towers are connected by telephone with the Headquarters camp, ranger cabins and nearby towns, and are furnished with good maps of the region which can be seen from the tower. Men are stationed in these towers only during dangerously dry weather, and when signs of a fire are seen they locate it on the map and notify the nearest ranger by telephone.

Besides the work accomplished in connection with the forest reserves a considerable amount of educational work has been conducted by the State Forester. Courses of general lectures on forestry have been given at the University of Wisconsin and many single lectures have been given before farmers' institutes and various clubs and organizations over the state. The Chicago and Northwestern railroad brought together many of its employes on two occasions so that the subjects of forestry and forest fire protection might be presented to them.

In addition to the biennial reports of the department, the following publications have been issued: "The Wood-Using Industries of Wisconsin," "The Taxation of Forest Lands in Wisconsin" and "A Preliminary Report on Storage Reservoirs at the Headwaters of the Wisconsin River." The material for the first two was compiled in coöperation with the U. S. Forest Service. Many educational articles on forestry have been prepared for various periodicals.

The Department has given advice and help to individuals who wished to undertake planting operations, and has coöperated with one of the railroads in testing spark arresting devices.

In connection with the University of Wisconsin, a successful effort was made to have the U. S. Forest Products Laboratory located at Madison, Wisconsin, and this has resulted in great benefit to the state, as experiments in the utilization of various woods are made here, the results of which are of great value, and the experts in charge of various divisions of the work give free instruction to students at the University of Wisconsin. The state provides a building together with heat, light and power, for the Laboratory.

The creation of artificial storage reservoirs on the important rivers of the state accomplishes to some extent one of the main purposes that forestry aims to accomplish, the production of a uniform stream flow. The constitution of Wisconsin prohibits the state from engaging in any work of internal improvement and therefore the state cannot build or operate reservoirs. The Forestry department, however, is heartily in sympathy with the construction and operation of such reservoirs by private parties, under the supervision of the state, and it aided as far as possible in securing the passage of a law that is a remarkable and unique piece of legislation and that protects the interests of both individual manufacturers and the people of the whole state. In this law, chapter 335 of the laws of 1907, the Wisconsin Valley Improvement Company is authorized to construct, acquire and maintain a system of water reservoirs on the tributaries of the Wisconsin river north of township 33 for the purpose of producing a uniform flow of water in the Wisconsin river and its tributaries and thereby improving the navigation and other uses of the said streams and diminishing the injury to property both public and private.

The State Board of Forestry supervises the construction of each dam, its location, height, the amount of land to be overflowed and the time and manner of drawing off water. The state railroad commission, acting in its capacity of public utilities commission, passes upon a fair capitalization for the company, distribution of stock and amount of tolls to be charged, the net annual return on the actual cash capital being limited to six per cent. The right is reserved to the state to take over the ownership of all reservoirs and property of the company by paying the amount of the cash capital that has been paid in as the actual value of the physical properties, in case the constitution of the state should ever be changed to permit the exercise of such ownership. The passage of this law marks a long stride in progress in the development of one of the greatest resources of the state.

At the present time the Wisconsin Valley Improvement Company controls a drainage area of 580 square miles, upon which are about 84 square miles of water surface, or 14%. Of this 84 square miles of water surface about 58 square miles, or 10% of the drainage area, is made up of lakes used for storage reser-

voirs. The total storage capacity on these lakes is about 5,000 million cubic feet, giving an average fluctuation of lake level of about three feet. Experience from similarly located lakes would indicate that in a condition of nature, without dams at their outlets, there would be a fluctuation of about 1½ feet, or about one-half that obtained by regulation. This gives a storage capacity of about 2,500 million cubic feet in excess of natural storage, and from which actual benefit is obtained. Reports show that the average yearly storage draft at certain points on the Wisconsin river for 1908–9 has been 5,840 million cubic feet. The benefit from this storage has been an increase of stream flow over that with natural storage, at and below Tomahawk of about 160 cubic feet per second, distributed over seven months. This 160 cubic feet per second would produce for each foot of head utilized, 18 water H. P. or about 13½ actual H. P. A water power plant utilizing 20′ head would then have an increase in available power of about 360 water H. P. or 270 actual H. P. for seven months of the year.

In 1911 a similar law was passed giving like authority to the Chippewa and Flambeau Improvement Company.

It is the intention of the Forestry department to carry steadily forward the work of increasing and blocking up the forest reserve area; to continue cutting roads and fire lines, and building telephone lines, and to erect a number of ranger cabins and lookout towers, so as to furnish adequate protection from forest fires; branch nurseries will be established and replanting will be done on areas that are not restocking naturally; a patrol system will be maintained on the forest reserves and an effort will soon be made to have the U. S. Forest Service coöperate more extensively in protection from forest fires by furnishing a larger number of men to patrol portions of the state during the fire season.

This department has agreed to coöperate with the state university in conducting a school for the practical training of forest rangers, the students to be employed during a portion of their course on the state forest reserves.

The Department is coöperating to some extent with the College of Agriculture in making a soil survey of the forest reserve area, as it is intended that the practice of forestry in the state shall not interfere in any way with general agricultural develop-

ment. The Department has pointed out in its published reports that there are over 13 million acres of land in northern Wisconsin awaiting development and it has been recommended that the best agricultural lands be settled rather than the poorer lands of questionable agricultural possibilities, so that settlers may not be doomed to poverty and comparative isolation and be deprived of good schools and the many advantages of a growing community.

An effort is being made also to bring about coöperative management of a large acreage of forest lands in Forest county, owned by the Chicago and Northwestern railway, the state and several companies engaged in wood-using industries.

Mention has already been made of a bill now pending in Congress to reimburse the state for the swamp lands that were included within the boundaries of the several Indian reservations.

Through the efforts of Congressman E. A. Morse, who introduced the bill in the House of Representatives, and Senator La-Follette, who secured its passage through the Senate, Congress in 1912 granted to Wisconsin as an addition to the state forest reserves, all the remaining unsurveyed and unallotted islands in inland lakes north of town 33. The forest reserves will thus be increased by about 250 islands, many of them most beautiful, and they will be leased for summer camps and cottages.

Urgent Necessity For Completing Forest Reserve.

The state forest reserves now comprise over 400,000 acres of land most of which is on the headwaters of the Wisconsin and Chippewa rivers, but in many cases the state lands are so badly scattered that it will be necessary to acquire about 1,000,000 acres more in order to block up and consolidate the reserves, which must be done in order to make forestry management, and especially fire protection, feasible. A forest reserve of 1,500,000 acres will include practically all of the nonagricultural lands in Forest, Oneida, Vilas, Iron and Price counties; protect the headwaters of our most important rivers; insure a large part of the future supply of raw material that our wood-using industries must have if they are to remain in Wisconsin; protect one of the most beautiful lake regions in the world, and through the sale of forest products, leasing of resort property, etc., bring a large and increasing revenue to the state.

The privately owned lands, which are scattered all through the state's holdings, are a constant menace to the forest reserve, as they are not settled or cared for in any way, but are very largely in the hands of nonresident owners. The truest economy on the part of the state will be to acquire these lands as soon as possible, so that the valuable young timber on them may be protected. It is a most wasteful and expensive policy for the legislature to postpone purchasing these lands until some indefinite future date, as such unprotected lands are the source from which start many of the most destructive fires, and the young timber that is destroyed has a much greater value than the cost of the land and timber at the present time.

The urgent necessity of making an appropriation sufficient to acquire the necessary lands was strongly emphasized by the special legislative committee on Water Powers, Forestry and Drainage, that was appointed at the end of the 1909 session, and which visited the reserves and made its report to the legislature of 1911. The members of this committee were divided on the subject of water power and drainage legislation, but both factions pointed out the great need of completing the reserves and recommended that for this purpose a state tax of 2/10 of a mill be levied and collected annually for a period of twenty years.

The State Conservation Commission and the State Board of Forestry made the same recommendations to the legislature of 1911, but the final result was a totally inadequate appropriation of $50,000 a year for a period of five years. The Joint Finance committee of the legislature of 1911 was opposed to granting a mill tax as they preferred to purchase lands by direct appropriations. The senate favored an appropriation of $200,000 a year for a period of ten years, but as the assembly cut down the appropriation to $50,000 a year for five years, it has been possible to purchase only some of the largest and most desirable tracts. Although the senate studied this matter carefully, the assembly did not give this question the consideration that its great importance deserves.

At each session of the legislature the cry of economy is heard, and the statement is made that taxes will have to be increased if the appropriations asked for are granted, and yet in 1911 the state remitted $940,235 in taxes and in 1912, $2,000,000. No one can justify foolish and extravagant appropriations of

state funds, but the prompt completion of the forest reserves is an absolutely necessary investment, which will yield large future returns, and when the state can remit nearly $3,000,000 in taxes in two years, the legislature must realize that funds are available to complete this important work which the state began nine years ago.

State Forest Reserve Policy.

The time has come when it is important for the legislature to clearly define the future policy of the state in regard to its forest reserves, so that all doubt on the part of settlers and land companies as to the boundaries of the permanent reserves may be set at rest. The State Board of Forestry has been criticised, because it has not announced a definite policy as to just where it was going to purchase lands for the forest reserve, but the mere statement of intention on the part of the Board is not sufficient, it should be backed up by legislative action.

In 1900 the legislature of New York, feeling that it was only fair and just that all citizens should be informed as to the location of the permanent forest reserves, passed the following act:

The Forest Preserve shall include the lands owned or hereafter acquired by the state within the county of Clinton, except the towns of Ottawa and Dannemora, and the counties of Delaware, Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, Oneida, Saratoga, St. Lawrence, Warren, Washington, Greene, Ulster and Sullivan, except:

1. Lands within the limits of any village or city, and
2. Lands not wild lands acquired by the state on foreclosure of mortgage made to loan commissioners.

New York has now acquired about 1,500,000 acres within the forest preserve, and will continue to purchase until they have secured all the forest lands that are unsuited for agriculture.

The Wisconsin state forest reserve now comprises some 400,000 acres, but it will be necessary to have a reserve of between 1,000,000 and 1,500,000 acres in order to block up and consolidate the present reserves; protect the headwaters of our most important rivers, and insure a future supply of timber for the important wood-using industries of the state.

This means that the state must purchase at least 800,000 acres of land in the permanent forest reserve area, and the lands to be purchased together with the lands already owned by the

state will probably make the acreage of the permanent forest reserve lands in the various counties approximately as follows:

	Acres
Vilas	506,000
Oneida	345,000
Forest	253,000
Iron	115,000
Price	70,000
Total	1,289,000

These lands would all be included within the boundaries of the permanent forest reserves, and it is recommended that a bill be passed by the legislature defining the boundaries of the reserve as follows: Commencing at the southwest corner of T. 38, R. 3 E., Price county, thence east along the south line of T. 38 to the eastern boundary line of Forest county, or the southeast corner of T. 38, R. 14 E.; thence north along the east line of R. 14 E., to the Wisconsin–Michigan boundary line, or the Menominee river; thence west along the Wisconsin–Michigan boundary line to the northeast corner of section 13 in T. 44, R. 4 E.; thence south on the east line of R. 4 E., to the northeast corner of T. 43, R. 4 E.; thence east to the northwest corner of T. 43, R. 4 E.; thence south to the northeast corner of T. 41, R. 4 E.; thence east to the northeast corner of T. 41, R. 2 E.; thence south to the southwest corner of T. 41, R. 2 E.; thence east to the northwest corner of T. 41, R. 3 E.; thence south to the southwest corner of T. 38, R. 3 E., or the point of beginning, excepting from the same the following:—

1. Lands within the limits of any village or city.
2. The following townships or portions of townships:
   (a) T. 39, R. 6, E.
   (b) The south half of T. 40, R. 6 E.
   (c) The east two-thirds of T. 38, R. 9 E.
   (d) The south two-thirds of T. 38, R. 10 E.
   (e) T. 38, R. 11 E.
   (f) T. 40, R. 10 E.
   (g) The north two-thirds of T. 41, R. 11 E.

The proposed act should clearly point out that it is the intention of the state to eventually acquire all the unoccupied and nonagricultural lands suitable for forestry within the boundaries of the forest reserve.

Necessary Legislation.

Completing the State Forest Reserves. The great need for the ultimate success of forestry work in this state is sufficient funds to consolidate and block up the present state forest reserves. Private holdings are scattered all through the state lands, and they are a constant menace to the forest reserves, as the state has no control over them and they are the source of most of the destructive forest fires. Adequate fire protection and systematic management will never be possible until the reserves are blocked up into a fairly solid body. The land that is needed can be acquired now at a much lower cost than later, and the initial investment will become immensely profitable to the state, as the forest reserves will in time bring in a large income from the sale of mature timber and the leasing of camp and cottage sites, besides the beneficial effect they will have on stream flow. Moreover, the state will profit greatly, though indirectly, from retaining the many wood-using industries within the state, and from the income that will go to railroads and resort owners from the summer tourist business.

This matter has been urged upon the legislature since 1907, and any further delay in providing the necessary funds will prove enormously costly to the state in the end. The Special Legislative committee on Water Powers, Forestry and Drainage, the State Conservation commission and other bodies have all recommended that an annual state tax of at least 1/10 of a mill should be levied and collected for a period of twenty years, the proceeds of the tax to be used for acquiring the necessary lands and for the improvement and protection of the forest reserve. The forestry department could then secure the lands at once, paying for them under land contracts as the funds became available. This is probably the most important and far reaching question of forestry policy that will ever come before the legislature of Wisconsin, and it is felt that they should give to it their earnest and careful attention.

Town Fire Wardens, Fire Wardens to act locally should be appointed directly by the State Board of Forestry and not be limited to short periods of service. Under the present law, which constitutes town chairmen and superintendents of highways local fire wardens, the fire wardens may change with every annual town election. It is exceedingly difficult for the State

Fire Warden to obtain accurate lists of the local fire wardens with their addresses. It is cumbersome and expensive to keep in touch with an *ever changing* force of men, to educate them in their duties and supply them with printed warning notices, report blanks and instructions.

The problem of forest fires is a serious one in the state. The enormous losses that occur periodically should be prevented. Experience has clearly demonstrated that such losses can be prevented only by *preventing* fires,—not by trying to extinguish them after they have started. The only effective system of preventing forest fires is by maintaining a patrol system during certain seasons of the year. Whether such a patrol system should be provided for by state funds or by a tax on the property protected, or by both, is a matter for the legislature to decide, but they should not neglect to provide for it in some way.

Dangerous Slashings. Another much needed measure should require owners of land on which there are dangerous slashings to clear a safe fire line between such slashings and adjoining timberland or other valuable property. Such a measure has been advocated by the lumbermen's association in this state but the legislature failed to pass it.

Taxation of timber lands. The present method of taxing forest lands is very unsatisfactory and is calculated to discourage the growing of timber. There are in the northern counties of the state large areas of essentially forest soil, land that will probably never be susceptible to any use other than the growing of timber. A law should be enacted that would encourage the owners of such land to hold it as a forest property and to apply practical forestry to the management. Such a law has been recommended by this department in detail, and should provide for the separate classification for taxation of land suitable for timber growing; that the land shall then be taxed separately from the timber, the assessed value per acre being limited to a certain amount; that whenever any timber or wood is taken from such land, the owner shall pay an amount equal to 10 per cent of its gross value on the stump; before any timber is removed from such land, the owner shall file with the state tax commission an accurate return under oath of the variety, amount and value of all material cut; that the assessment and collection of such tax on the timber be in the control of the state; that the determination of the suita-

bility of lands for timber growing rest with the State Board of Forestry and that in the event of an affirmative decision the Board submit to the owner a plan for the management of the timber and certify to the tax commission that the land has been separately classified for taxation; the management of such lands should be under the supervision of the State Board of Forestry; if an owner fails to comply with any provision of the law, his certificate classifying his land shall be canceled and he shall be required to pay an amount equal to the taxes under the general property tax for the period of time that the land was separately classified.

Soil Survey. The work on the soil survey of the state should be pushed as rapidly as possible so as to grade the soils and determine where the nonagricultural lands lie, as it is of great importance both to the forestry work and to landowners,—to say nothing of the incoming settlers—to have it finally determined just what lands are agricultural in character and what are not.

Storage Reservoirs. Mr. C. B. Stewart, the hydraulic engineer who has been retained by the State Board of Forestry to make necessary investigations in relation to proposed storage reservoirs, has reported that it is very important that the state should acquire information at an early date in regard to the storage problem on all of its main rivers. All natural basins at the headwaters of the Wisconsin river should be carefully investigated and if found more suitable for storage purposes and for benefit to the river as a whole, than local power development, the site could be reserved and developed accordingly. The U. S. Government engineers made preliminary surveys for reservoir sites at the headwaters of the Wisconsin, Chippewa and St. Croix rivers in 1880, and reported available storage capacities to the amounts of 19, 25 and 34 billion cubic feet, respectively. Conditions of development along the shores of the lakes and rivers since then, however, have probably progressed to such a point that it will be impossible to obtain one-half of what may then have been feasible.

Game Preserve. An appropriation of $20,000 is requested with which to enclose some 8,000 to 10,000 acres of forest reserve lands now owned by the state, with a game proof fence and to stock this preserve with elk, moose, deer, game birds and fur bearing animals. The federal government and sportsmen who are inter-

ested in game preservation will coöperate with the state in securing the elk, moose, pheasants, etc., and the deer and fur bearing animals can be secured within the forest region at little cost. As the game increases within the preserve, the surplus would be released and the moose and elk, at least, should be protected by law for a number of years.

The state expends annually a large amount in the propagation of fish, but so far the state has never done anything towards the propagation of game. The sportsmen of the state object to any of the funds derived from the sale of hunting or fishing licenses being turned into the general fund of the state, as they contend that all funds so derived should be used in the propagation and protection of fish and game. It is therefore suggested to the legislature that the appropriation of $20,000, which is asked for the game preserve, should be paid out of the hunting and fishing license fund.

State Lands For Sale.

As was fully explained in the report of the State Forester for 1909–10, the State Board of Forestry is authorized to sell the scattering and agricultural lands north of town 33, the proceeds of such sales to be used in blocking up and consolidating the permanent forest reserves, and in their protection and improvement.

The cruisers' reports are very complete and are on each forty separately, showing the amount of timber of each kind, and its stumpage value, the character of the land, whether rolling, hilly, or flat, and if stony; the soil is shown as loam, clay or sand, or more definitely described if necessary; if swampy, whether it can be drained; also character and amount of young growth.

During the summer of 1912 all the state lands in Oneida county, south of the north line of township 37 have been carefully examined and appraised. It was hoped that these lands could be offered for sale in the fall of 1912, but their examination and appraisal was not completed until about November first, and as all state lands must be advertised for at least six weeks before being sold, it would have resulted in obliging those interested in purchasing lands to look them over when covered with snow, and therefore it was deemed advisable not to sell the lands until the spring of 1913.

The state lands in the following counties are now on the market and can be purchased at any time, and in addition the State Board of Forestry intends to sell all the state lands in Marinette county and the lands south of the north line of township 37 in Forest county.

The following table shows approximately the amount of land on the market north of town 33, that remained unsold on January 1, 1913.

STATE LANDS ON THE MARKET.

	Acreage.		Acreage.
Ashland	4,166.20	Oneida	400.00
Bayfield	1,559.74	Polk	1,842.57
Burnett	6,217.83	Price	9,757.87
Douglas	1,276.02	Rusk	2,254.47
Florence	3,559.16	Sawyer	11,771.26
Iron	1,723.32	Washburn	3,985.09
Langlade	1,418.42		
Lincoln	1,558.10		51,490.05

The following table shows the approximate acreage of state land in eight counties that will probably be offered for sale in the spring or summer of 1913. The acreage in Forest, Marinette and Oneida includes all the land in those counties that it has been decided to eliminate from the permanent forest reserve.

STATE LANDS TO COME UPON THE MARKET.

	Approx. acreage.		Approx. Acreage.
Douglas	1,989.79	Price	3,040.00
Florence	80.00	Rusk	200.00
Forest	11,880.00	Sawyer	211.95
Marinette	4,494.21		
Oneida	19,680.00		41,575.95

Many of the above lands are suitable for agriculture, and in fixing the appraisal of each forty, the value of the land and of the timber was figured separately. Those who are desirous of purchasing lands in any of these counties can secure lists showing the appraised value of each forty of state land by applying either to the State Land Office, or State Board of Forestry.

TIMBER TRESPASS.

It is again recommended that the civil liability for timber trespass be increased from double to triple the value of the timber taken, plus all the costs of examination and survey. Nothing special can be added to the statement in regard to this matter contained in the report of this department for 1909–10, which follows.

The government and state practically encouraged timber trespass upon public lands for so many years by allowing trespassers to settle by simply paying the value of the timber taken, that it has been very difficult to stop the practice at once and to make such people understand that illegal cutting of timber is nothing more nor less than common stealing.

In 1905 the law was strengthened so that the civil liability for forest trespass is now double the amount of damages suffered and under criminal action the fine is not less than $25, nor more than $1,000, or imprisonment not less than fifteen days nor more than three years, or both fine and imprisonment. The result of this law has been to largely put a stop to all forms of trespass upon state lands, as it does not pay to cut timber illegally when one is obliged to pay double the value of the timber taken, plus all the costs of examination and survey.

Public opinion in northern Wisconsin, however, has not yet been educated to support a jail sentence for a trespasser, unless in the case of an old offender and when the trespass has been glaringly flagrant and willful. This is especially true in the case of a poor man with a family, as the jury seems to reason that if the man is sent to jail, his family will become a charge upon the county or town. After years of "rubber forties" and practical encouragement, the law cannot suddenly be made too drastic and still meet with public support.

However, the whole stumpage law has been in operation for over five years, and it is now recommended that it is time to still further strengthen this law. The law of New York state provides a penalty of $10 for every tree cut on state lands but so drastic a law in Wisconsin at the present time would probably defeat its own ends. It is recommended that the civil liability for timber trespass be increased from double to triple the value of the timber taken, plus all the costs of examination and survey. Both the state and private timberland owners have been put to considerable trouble and loss in past years by Christmas tree trespass. Large firms in Chicago, Milwaukee, St. Paul and other nearby cities make contracts with small jobbers or settlers to furnish a large number of Christmas trees. These contractors have been in the habit of going upon any land where there was a fine growth of young pine and cutting it all off in a few days' time. Many such trespassers are not resi-

dents of Wisconsin and they can cut, load and ship these small trees so rapidly that it is very difficult to detect them until the trees have been shipped and then the offenders are outside the jurisdiction of the state. However, timberland owners have dealt with such cases as severely as possible by imposing heavy fines, confiscating the trees cut and also bringing criminal action, so that this business is being largely discouraged and the dealers are compelled to buy the young trees from those who are willing to have them cut. The state has only suffered to a slight extent from such operators, as our lands are watched closely as Christmas approaches and we have been able to detect nearly all such cutting in time. The children and grown-ups need not fear that there will be any shortage of Christmas trees in the future or that foresters will discourage this old custom.

Upon lands that are protected from fire thousands of young pines will come up to the acre, and if left to themselves to follow out nature's law there will be a fierce struggle for existence, so that only a small percentage will survive. These will be the strongest and best developed but by far the greater number will gradually die and fall to the ground. Even the strongest young trees that survive are checked in their growth during the years of their fiercest struggle for existence and the forester can aid nature by cutting out the less promising trees and thereby allowing the stronger to shoot ahead free from the struggle.

Such cuttings are called "improvement thinnings" and are an important part of forestry work in all foreign countries where there is a ready market for the young trees that are thinned out.

In this country the forester as a rule has not been able to make improvement thinnings as there has been no market for such young trees, but the demand for Christmas trees promises to furnish the market to a considerable extent and therefore the forester hopes that more Christmas trees will be used and not less. However he wants such young trees cut out under a system that will hasten the rate of growth and improve the future forest and does not want to have every tree cut by a person who is politely called a trespasser while in fact he is nothing less than a common thief.

FORESTRY PROBLEMS IN GENERAL

The Town Fire Warden System.

In the report of the State Forester for 1909–1910, it was recommended as strongly as possible that the system of town fire wardens should be abolished and that in its place a well organized system of forest fire patrols should be provided. During 1908 the reports of the fire wardens showed that 1,200,000 acres were burned over, with a loss amounting to $9,000,000, and in 1910 some 892,000 acres were burned over with a loss of $5,000,000. During these same years the losses from forest fires in Minnesota and Michigan had also been enormous, and in order to work out a better system of fire prevention the Governor of Minnesota invited representatives from Michigan and Wisconsin to attend a Lake States Forest Fire conference, which was held at St. Paul on December 6th and 7th, 1910.

The conference was an unusually strong and representative one, headed by the Governors of Minnesota and Wisconsin, members of the legislative committees on forestry from the Lake states, and also lumbermen, foresters, and so forth.

The sense of the meeting was that the enormous annual forest fire losses in the Lake states were a public disgrace; that the old system of doing nothing until the fire occurred had always and everywhere proved to be little better than no system at all, and that the only sensible, practical plan was to concentrate the efforts of each state to building up the best possible system of fire prevention.

At the end of the two days' meeting the following resolutions were unanimously adopted:—

Resolved, That we recommend to the legislatures of our States:

First. That the forest fire protection of each State and such other branches of state work as may be deemed best to combine with it, be placed under the control of a non-partisan Commission empowered, as fully as possible under the Constitutions of the different States, to carry on the work, and under civil service rules. Such Commission should represent all the interests involved as far as possible, and we recommend that such Commission place the work in charge of a Chief Forester who should be a professional graduate Forester and that the Commission employ such trained Foresters and other assistants as may be necessary; define their duties and fix their salaries; said employes to

be engaged under such civil service regulations as the Commission may prescribe.

Second. Resolved, That it is the sense of this Conference that the present Forest Fire Warden Service of Michigan, Wisconsin and Minnesota, is totally inadequate to meet the existing fire hazard to both life and property, and that forest protection service, to become efficient, must be greatly extended. To this end we recommend an adequate Forest Patrol System, maintained by the State, organized and operated by the Commission referred to.

Third. We further recommend, that the Commission be authorized to coöperate with the National Government, the several adjoining States, and such associations and organizations as the Commission may find necessary to best protect the timber resources of the State.

Fourth. Resolved, That this Conference is opposed to a general slash burning law, as experience has proven it unsatisfactory, impractical and dangerous. We recommend, however, that the Commission should be given authority to order the disposal of dangerous slashings sufficient to establish a safe fire line around standing timber or other valuable property.

Fifth. Resolved, That this Conference advocates legislation providing strict regulation of the burning of brush and debris in clearing land during the dry season, such burning to be under the direction of the State fire patrolmen under such regulations as the Commission may prescribe.

Sixth. We further recommend, that the burning of all debris on the rights of way of the various railroads be under the control and direction of the State Forest Patrol. Further, that under special conditions as directed by the State Forest Patrol the railway companies maintain a patrol, properly equipped following their trains, also that all railroad and logging locomotives and traction engines must be equipped with the most practical spark arresting devices subject to inspection and approval of the Commission.

Seventh. Whereas, The building of fire lines around exposed property including settlements, villages and towns, has proven a most effective means for the control and extinguishment of fires, we recommend, that one of the principal duties of the patrolmen working under the direction of the Commission, should be to establish such fire lines where necessary for protection of property.

Eighth. We recommend, as the most effective measures for preventing and fighting serious fires, adequate means of transportation and communication, to include trails, telephone lines and lookout stations, and that the efforts of the Commission should be exerted toward the construction and establishment of the same as rapidly as consistent.

Ninth. The appalling sacrifice of life and the continued great loss of State and private property resulting from fires in our forested area, are a disgrace to our civilization and a most serious drain upon our natural resources, and we believe that the expenditure of such amount as may be necessary to prevent these losses is fully justified.

We therefore recommend, that the appropriation by the State Legislatures to maintain forest protection should be sufficient to provide for a Forest patrolman for each forty thousand acres requiring protection as well as for the expenses necessary to successfully carry out all of the measures suggested by these resolutions.

Tenth. We recommend, in addition to the Patrol System, an auxiliary County fire fighting force to be appointed by and under the direction of the Commission, to be paid by the State and charged back to the Counties. Such expense to be ultimately borne by the Counties or towns in which the fires occur.

Further Be It Resolved, That as it is shown by statistics that there are a large number of fires set each season through the carelessness of the general public, including campers, fishermen, hunters and others, we recommend, that a campaign of education be energetically carried on through every possible channel to the end that this hazard be reduced through a better understanding of forest conditions by all the people.

It will be noted in the second article of the above resolution the Conference stated that the town fire warden system was totally inadequate and recommended a forest patrol system maintained by the state.

A bill was introduced in the Wisconsin legislature of 1911 to provide for a state forest fire patrol, but the legislature refused to appropriate state funds for this purpose, and the legislative committee changed the bill so that all lands benefited by the patrol would pay a special tax of 2½ cents per acre, per annum. The timberland owners refused to agree to this amendment with

the result that the bill was killed. Wishing to accomplish something, the legislature passed a law providing that town chairmen should act as town fire wardens, and that road supervisors should be deputy town fire wardens. The idea of this law was to place the responsibility for and the cost of, fighting fires directly upon the local community where they occurred. It is only a makeshift, however, and is especially weak and inefficient for the following reasons:

1. Some of the best men in the towns are elected as town chairmen and road supervisors, but because they are good men it does not naturally follow that they have the strength and endurance or the knowledge of how to fight forest fires. The impression seems to prevail that anyone can fight forest fires. Almost any fairly able-bodied man can assist very materially, but the men in charge of the work must know the country thoroughly, and, more important still, must know just where and how to attack the fires. Experienced woodsmen should be in charge of the fire warden system in each town, and not simply some good man who happens to hold an office and upon whom it is easy to assign another duty by law.

2. The towns that have the most timber are always, for that very reason, either without any settlers at all, or else both settlers and roads are very few. Such towns, as a rule, have no road supervisors, and as a result, where the fire warden system should be the strongest it is in fact the weakest, and vice versa.

3. The town chairmen and road supervisors almost never take any action until the fire actually occurs. In other words, the present law makes the same old mistake of providing for fighting fires, but not preventing them. Prevention is the watchword of any successful fire warden system, and this has been proved in every state from the Atlantic to the Pacific. No city of any size would think of being without a fire department, and no town containing a large area of timberlands should be without a strong fire warden system which would devote its efforts in the first place to preventing fires.

Forest Fires in 1911 and 1912.

It is a great pleasure to be able to report that during the forest fire seasons of both 1911 and 1912 there was so much rain and the rain was so well distributed throughout the summer months

that only a few thousand acres in the entire state were burned over, and the losses were almost nothing as compared to recent years. Unfortunately, under the new law of 1911, which makes all town chairmen fire wardens, it has been found impossible to secure enough reports to compile any fairly accurate statistics for the last two years, but enough reports have been received to show that the losses have been very small.

This fine showing is due almost entirely to wet seasons, and compares as follows with the losses in the three years before:

	Acres burned	Loss
1908	1,200,000	$9,000,000
1909	166,751	104,012
1910	892,833	5,000,000

We are now apparently in a cycle of wet years and may have two or three more rainy seasons. But these cycles are not well defined, and therefore we must always be prepared for a dangerously dry season, and because we have been so fortunate in 1911 and 1912 there is the more danger in the next few years.

Some thirty small fires occurred on the state forest reserves in 1911 and 1912, but they were quickly detected and extinguished by the forest rangers and patrols before they did any considerable damage. These wet seasons were taken advantage of to the fullest by building up the permanent protective system of roads, fire lines, lookout towers and telephones on the state forest reserves, but unfortunately almost no protective work has been done on any of the privately owned timberlands of the state, and another dry season will again bring enormous forest losses unless a strong, well organized fire patrol system is built up at once.

Emergency Fund for Fire Fighting.

The state forest reserves after seven years of almost continuous selling of scattered and agricultural state lands, and purchasing non-agricultural lands in the permanent forest reserve area, are gradually being consolidated into fairly solid blocks, and it is a comparatively easy matter to prevent the spread of destructive forest fires in a solid body of timberlands.

The reserves have been divided into districts with a forest ranger in direct charge of the work in each district, and when a fire occurs in the reserves, it is quickly detected by means of the lookout towers, and help is promptly summoned by means of

the telephones, which connect the lookout towers with the Headquarters camp, ranger cabins and nearest towns. As the protective system of roads, fire lines, telephones, lookout towers, etc., is extended to cover all portions of the forest reserve, the danger of a destructive, wide-spread fire, which would get beyond control, becomes less and less, but nevertheless each season has its dangerously dry periods and therefore the Department must have available at all times sufficient funds to fight any forest fires that may occur.

The forest reserve fund into which is paid all the proceeds arising from the management of the forest reserve, is considered first of all as an emergency fire fighting fund, and after a safe reserve has been set aside the balance of the fund is used in purchasing land and for the improvement and protection of the forest reserve.

It is felt that the forest reserves are now fairly safe from destructive fires, and that they will be very well protected in a few years, and also that the forest reserve fund will be a sufficient emergency fund in most cases. Unfortunately, the situation in the northern timbered portion of the state, outside of the forest reserve, is quite different, as there is practically no protective system and the danger of forest fires is very great. The legislature of 1911 provided that all town chairmen should be town fire wardens, and superintendents of highways deputy town fire wardens, and that the expense of preventing or extinguishing forest fires should be borne by the road district within which the expense was incurred. In addition the law provided that in cases of emergency, or where a town has no highway superintendent, or is unusually large, the State Forester might appoint special fire wardens, and that the expense of preventing or extinguishing forest fires by these special fire wardens should be borne on the basis of one-half by the county in which the fire occurred, and one-half by the state. The law continues,

2. No payment shall be made to any claimant under this section until he shall have presented an itemized account, and made oath or affirmation that said account is just and correct, which account shall be approved by the county board, and audited by the county clerk. The county clerk shall thereupon issue to such claimant his warrant upon the county treasurer for the sum to which such claimant is entitled, and the county treasurer shall pay the same.

3. The county clerk shall transmit the original oath and copy of the warrant to the secretary of state, who shall audit such claim, and one-half thereof shall be paid out of the general fund of the state treasury by warrant issued by the secretary of state upon the state treasurer in favor of the county which paid such claimant, and such amount shall be forwarded to the county treasurer of such county. However, no county shall expend more than five thousand dollars under this act in any one year.

From the above it will be clearly seen that it was the intent of the legislature to create an emergency fire fighting fund of $10,000 for each county, but a very bad feature of the law is that the men who are called out to fight fire must wait for their pay until the county board can meet and approve the bills. Anyone who knows lumberjacks knows that they are a very shifting population, who are always hard up, and if they were obliged to wait several months for their pay for fighting fire, they would flee from the next summons as they would from the evil one. In order to be a practical workable law some way must be found to pay men promptly who are called out by the fire wardens to fight forest fires.

It is recommended that the bills should be promptly paid by the state treasurer when approved by the fire warden in charge of the fire and also by the State Forester, and that the state treasurer should collect from each county one-half the expense of fighting forest fires, but that in no case should any county be called upon to pay more than $5,000 in any one year.

Spark Arrester Inspection.

The passage of chapter 494, laws 1911, gave Wisconsin one of the strongest and most practical laws in the country for reducing the number of forest fires set by railway locomotives, donkey, traction and portable engines. The following provisions of the law are worthy of special note:

1. Between March 1st and December 1st all logging locomotives, donkey, traction or portable engines, which are operated in, through or near forest, brush or grass land, and which do not burn oil as fuel, must be equipped with screens or wire netting on top of the smokestack, and so constructed as to give the most practicable protection against the escape of sparks and cinders. "The term logging locomotive as used in this act shall be construed to mean any locomotive operated on a railroad, branch line or division, the chief or main business of which is the transportation of logs, lumber, or other forest products." The great value of this provision of the law will be at once apparent to any forester, as it compels every locomotive which is operated through the forests to be equipped with the oldest, simplest, and yet by far the most effective device for preventing the escape of sparks or cinders, namely, a screen or hood over the smokestack.

Locomotives that are operated on main through lines and that make long runs, could not be equipped in this way, for with the smokestack covered with a hood the front end of the engine would clog up with cinders, and then of course the engine could not steam or pull its load. Therefore the law provides that "all locomotives operated on any railroad other than a logging railroad shall be equipped with the most practicable spark arresters so constructed as to give the greatest possible protection against the escape of sparks and cinders from the smokestacks thereof, and each such engine shall be provided with the most practicable device to prevent the escape of the coals from ash pans, and fire boxes, and such devices between March 1st and December 1st shall at all times be maintained in good repair."

2. The law provides that the superintendent of motive power or equivalent officer on each railroad shall designate an employe of such railroad at each division point and roundhouse, who shall examine each locomotive each time it leaves the division point or roundhouse between March 1st and December 1st, and such employe shall be held responsible for the proper carrying out of the provisions of this section, but without relieving the company from its responsibility hereunder. This provision of the law has proved very effective in keeping the locomotives in proper condition, and also in bringing about real coöperation between the state and the railroads.

3. It will be noted that the law provides that screens or hoods on the smokestacks must give the "most practicable protection" and that spark arresters must be constructed so as to give the "greatest possible protection." The question naturally arises as to who shall decide as to the most practicable device and as will be noted, this is provided for in the following section which is the strongest part of the entire law:

3. Any locomotive inspector designated by the state board of forestry shall have the power to reject from service immediately any locomotive, donkey, traction, or portable engine which, in the opinion of the said inspector, is deficient in adequate design, construction, or maintenance of the fire protective devices designated in sections 1 and 2 of this section, and any such locomotive, donkey, traction, or portable engine so rejected from service shall not be returned to service until such defects have been remedied to the satisfaction of the state board of forestry. In case of disagreement between said inspector and the owner of the locomotive, donkey, traction, or portable engine so rejected from service as to the efficiency or proper maintenance of said protective devices, then the owner of said locomotive, donkey, traction, or portable engine may appeal to the railroad commission of Wisconsin for a decision of said matter, but pending such decision the said locomotive, donkey, traction, or portable engine shall not be returned to service.

Particular attention is called to the fact that any defective engine can be ordered out of service and that it cannot be re-

turned to service until the defects have been fully remedied. This provision of the law is extremely important and is far more effective than the usual fines, for any railroad company that was inclined to disregard the law would be quickly brought to its senses by having its locomotives ordered out of service.

4. Minor though important provisions of the law are:

a. Railroads must provide patrols for duty along their tracks in dangerously dry weather, and if any railroad company fails to provide such patrols after due notice, the State Board of Forestry may employ patrols and the cost shall be charged to the railroad company.

b. Every railroad must at least once every year cut and burn, or remove from its right of way all grass, weeds, brush, logs and refuse material.

c. No railroad company shall permit its employes to deposit fire, live coals or ashes upon their tracks outside of the yard limits, except they be immediately extinguished.

d. Engineers, conductors or trainmen who discover fires along the right of way, or on lands adjacent to the railroad, shall report the same to the agent at the nearest telegraph station. The railroads of Wisconsin have come to realize within the last few years that they are more directly interested in preventing forest fires than any other great industry in the state, and as a result of this realization they are anxious to do their full share in putting a stop to forest fires that are caused by the railroads.

The main causes of railroad fires are sparks, which escape from the smokestacks, and live coals, which are dropped by the ash pans. The Chicago & Northwestern railway has been coöperating with the state for the last three years in an endeavor to perfect a spark arrester which would prove entirely satisfactory in preventing the escape of sparks, and though great progress has been made, complete success has not been secured as yet. It is a comparatively simple matter to get an arrester that will stop a locomotive from throwing sparks, but very difficult to find one that will also allow the engine to steam freely and pull its load.

The State Board of Forestry has a locomotive inspector, who devotes his entire time from March 1st to December 1st to inspecting locomotives in the forest regions of the state, and he is constantly working with the railroad officials to perfect improved devices. Following is a brief summary of his report for 1912:

Spark Arresters.

The Chicago & Northwestern railway now uses the Slater box front end on nearly all of their engines operating in the forest reserve regions. This front end is a big improvement over the old style known as the Master Mechanic front end. Fifteen night runs were made on engines equipped with the box front end, and several on engines equipped with the old style front end. Less sparks are thown from the stack when the box front end is used, and it is estimated that less than five per cent of the sparks are alive when they strike the ground. They are nearly all self cleaners while the old style are not, but the engine crews state that they are harder to steam with than the old style and that they use considerably more fuel.

The Great Northern railway has experimented during 1912 with a new spark arrester which is known as the Cannon or Conical front end. Four night runs were made on engines equipped with this arrester and one night was also spent in the tower at Saunders, Wis., watching 25 engines which passed. Very few sparks are thrown from the stack, and only occasionally would one reach the ground alive. The engine crews do not appear to have any fault to find with this arrester.

A number of other spark arresters are being tested and the necessity for finding the best possible device is so great that the investigations will be continued along all possible lines.

Hoods and Screens.

The Chicago, Milwaukee and St. Paul railway during 1912 has used a very satisfactory hood on all its engines, operated through forest lands. The hood is fastened to the top of the smokestack with a hinge at the back, and at first engineers and firemen were inclined to tip the hood back when they thought there was not much danger from forest fires, but close supervision and the fact that one or two men were laid off by the railroad for doing this, has largely put a stop to this dangerous practice. This is considered to be the best hood in use, the only objection to it being that the cinders are apt to fly back into the engine cab, but in August a device was perfected that overcomes this trouble to a certain extent.

The Chicago & Northwestern railway, early in the summer of 1912 used a hood that did not prove a success as the engines do not steam well after they have been run 8 to 10 miles. Later in

the season another hood was tried which apparently promises to give very good satisfaction.

Some of the smaller railroads and a number of lumber companies used the old diamond stack, with a large top and cone well down in the stack. This type of stack has been found very expensive to keep in good repair, and the front ends sometimes choke up as they collect a lot of cinders. It would appear that an entirely satisfactory hood has not been worked out as yet, but the type of hood that is used by the Chicago, Milwaukee & St. Paul railway is fairly satisfactory.

Ash Pans.

Hopper bottoms. There are many of this type now in use, but frequently a hopper ash pan that is supposed to be in perfect condition is found upon close examination to still allow room for some live coals to fall through. It seems absolutely impossible to make a sliding or tilting door that will not warp or crack and that will always come up tight.

The Chicago, Milwaukee & St. Paul engines are equipped with one of the very best types of hopper ash pans now in use. They are an improved Chicago, Burlington & Quincy railway ash pan and are considered to be a great improvement over the original. The doors open at the ends and are equipped with an automatic latch which is easily opened and which cannot be jarred open. About forty of these ash pans were inspected during the season and only one defective door was found.

The hopper ash pans which were in use by the Omaha railway early in the season of 1912 were found to be a very inadequate type and in bad condition. The many forest fires that occurred along its lines in 1908 and 1910 were undoubtedly very largely caused by these ash pans. In the latter part of July, 1912, this road began to equip its engines with a new ash pan which is known as the swipe pan, and which has a sprinkler blow-out. This type of ash pan gives promise of proving very satisfactory. The following tables show the condition of the engines that were examined during 1912.

LOCOMOTIVE INSPECTION 1912.

Examination.		Condition.					
Date.	Place.	Total no. engines.	Good.	Fair.	Bad.	In shop for repairs.	Ordered out of service till repaired.
	Chicago, Milwaukee & St. Paul Railway Company.						
May 23	Green Bay, Wis.	14	8	2	2	2	.....
24	Green Bay, Wis.	24	10	7	4	3	.....
28	Iron Mountain, Mich.	1	1	.....	.....	.....	.....
June 18	Wausau, Wis.	6	3	3	.....	.....	.....
19	Tomahawk, Wis.	11	8	2	.....	1	.....
Aug. 14	Green Bay, Wis.	8	7	.....	1	.....	.....
Sep. 11	Tomahawk, Wis.	10	8	2	.....	.....	.....
20	Portage, Wis.	8	5	1	2	.....	.....
21	Madison, Wis.	7	.....	1	6	.....	.....
23	Watertown Jct., Wis.	4	2	1	1	.....	.....
25	Milwaukee, Wis.	6	2	3	1	.....	.....
Oct. 1	Janesville, Wis.	7	4	2	1	.....	.....
		106	58	24	18	6	.....
	Wisconsin & Michigan Railway Company.						
May 21	Peshtigo, Wis.	5	1	1	1	2	.....
21	Peshtigo, Wis. John Marsh. Eng.	5	1	1	.....	3	.....
Aug. 17	Peshtigo, Wis.	1	1		.....	.....	.....
		11	3	2	1	5	.....
	Bayfield Transfer Railway Company.						
Apr. 22	Bayfield, Wis.	2	.....	1	1	.....	.....
		2	.....	1	1	.....	.....
	Wisconsin Northern Railway Company.						
May 18	Crandon, Wis.	1	1	.....	.....	.....	.....
29	Shawano, Wis.	2	1	.....	.....	.....	1
		3	2	.....	.....	.....	1
	Marinette, Tomahawk & Western Railway Company.						
May 1	Tomahawk, Wis.	2	2	.....	.....	.....	.....
June 19	Tomahawk, Wis.	2	1	1	.....	.....	.....
		4	3	1	.....	.....	.....
	Lake Superior Terminal & Transfer Railway Company.						
June 29	Superior, Wis.	14	.....	1	10	2	1

Examination.		Condition.					
Date.	Place.	Total no. engines.	Good.	Fair.	Bad.	In shop for repairs.	Ordered out of service till repaired.
	Illinois Central Railway Company.						
Sept. 21	Madison, Wis	1	.....	1	.....	.....	.....
		1	.....	1	.....	.....	.....
	Chicago, Burlington & Quincy Railway Company.						
Oct. 3	La Crosse, Wis	7	6	1	.....	.....	.....
		7	6	1	.....	.....	.....
	Northern Pacific Railway Company.						
June 22	Ashland, Wis	2	.....	1	1	.....	.....
		2	.....	1	1	.....	.....
	Duluth, South Shore & Atlantic Railway Company.						
June 29	Superior, Wis	1	.....	1	.....	.....	.....
July 5 & 6	Thomaston, Mich	3	3	.....	.....	.....	.....
		4	3	1	.....	.....	.....
	Green Bay & Western Railway Company.						
May 24	Green Bay, Wis	16	.....	9	5	2	.....
Aug. 15	Green Bay Wis	11	3	.....	4	4	.....
26	Grand Rapids, Wis	3	.....	1	1	.....	1
		30	3	10	10	6	1
	Yawkey Bissell Lumber Company.						
May 10	Arbor Vitae, Wis	1	.....	1	.....	.....	.....
June 5	Tomahawk, Wis	1	.....	1	.....	.....	.....
July 12	Arbor Vitae, Wis	3	2	.....	1	.....	.....
Aug. 2	Arbor Vitae, Wis	3	1	2	.....	.....	.....
		8	3	4	1	.....	.....
	Omaha Railway Company.						
Apr. 19	Ashland, Wis	2	.....	1	1	.....	.....
June 22	Ashland, Wis	5	5	.....	.....	.....	.....
Apr. 19	Spooner, Wis	12	7	4	1	.....	.....
Apr. 20	Itasca, Wis	10	3	6	1	.....	.....
July 18	Itasca, Wis	5	3	2	.....	.....	.....
Apr. 22	Washburn, Wis	1	1	.....	.....	.....	.....
July 26	St. Paul, Minn. W. End Shop	4	3	1	.....	.....	.....
	St. Paul, Minn. E. End Shop	7	4	1	2	.....	.....

Examination.		Condition.					
Date.	Place.	Total No. engines.	Good.	Fair.	Bad.	In shop for repairs.	Ordered out of service till repaired.
	Omaha Railway Company—Continued.						
July 27	Altoona	17	9	3	2	1	2
Aug. 27	Marshfield, Wis	1	.....	.....	1	.....	.....
Oct. 4	Wyeville, Wis	2	1	.....	1	.....	.....
		66	36	18	9	1	2
	M. St. P. & Sault Ste. Marie Railway Company.						
June 3	Rhinelander, Wis	3	1	.....	2	.....	.....
21	Ashland, Wis	13	4	2	2	5	.....
27	Superior, Wis	15	6	4	4	.....	1
July 16	Superior, Wis	11	9	.....	2	.....	.....
18	Weyerhaeuser, Wis	6	3	1	2	.....	.....
27	Chippewa Falls, Wis	7	7	.....	.....	.....	.....
27	Shoreham, Minn	35	25	8	2	.....	.....
Aug. 23	North Fond du Lac, Wis	18	16	2	.....	.....	.....
27	Stevens Point, Wis	13	11	2	.....	.....	.....
		121	82	19	14	5	1
	Chicago & Northwestern Railway Company.						
May 18	Antigo, Wis	8	5	2	.....	1	.....
21	Marinette, Wis	2	2	.....	.....	.....	.....
25	Green Bay, Wis	40	18	12	7	2	1
28	Iron Mountain, Mich	1	1	.....	.....	.....	.....
28	Strambaugh, Mich	5	2	3	.....	.....	.....
29	Wabeno, Wis	1	.....	.....	1	.....	.....
June 10	Watersmeet, Mich	5	.....	.....	5	.....	.....
21	Ashland, Wis	10	8	1	1	.....	.....
Aug. 6	Antigo, Wis	14	10	3	1	.....	.....
7	Eland Jct., Wis	6	4	.....	2	.....	.....
16	Green Bay, Wis	17	9	2	1	5	.....
20	Marinette, Wis	1	1	.....	.....	.....	.....
21	Kaukauna, Wis	7	5	.....	.....	2	.....
24	North Fond du Lac, Wis	14	10	2	2	.....	.....
27	Marshfield, Wis	5	4	.....	1	.....	.....
Sept. 21	Madison, Wis	5	3	2	.....	.....	.....
23	Baraboo, Wis	6	4	1	1	.....	.....
23	Watertown Jct., Wis	2	2	.....	.....	.....	.....
26	New Butler, Wis	10	3	2	5	.....	.....
Oct. 1	Janesville, Wis	13	8	3	1	.....	1
2	Galena, Ill	3	1	2	.....	.....	.....
4	Wyeville, Wis	7	5	1	1	.....	.....
5	Wausau, Wis	3	2	.....	1	.....	.....
		185	107	36	30	10	2
	Great Northern Railway Company.						
July 2	Allouez, Wis	5	.....	5	2	.....	.....
3	Superior, Wis	17	6	3	6	.....	2
17	Allouez, Wis	9	2	3	4	.....	.....
18	" "	10	1	4	5	.....	.....
18	Superior, Wis	22	5	8	3	6	.....
		63	14	21	20	6	2

Logging Railways.

Examination.		Condition.					
Date.	Place.	Total No. engines.	Good.	Fair.	Bad.	In shop for Repairs.	Ordered out of service till repaired.
1912.							
Apr. 30	Buswell Lbr. Co., Buswell, Wis.	1	.....	.....	1	.....	.....
May 11	Vilas County Lbr. Co., Fosterville, Wis.	1	.....	.....	1	.....	.....
13	Brown Bros. Lbr. Co., Rhinelander, Wis.	1	.....	1	.....	.....	.....
17	Hackley-Phelps-Bonnell Lbr. Co., Hackley, Wis.	2	.....	.....	2	.....	.....
17	Keith & Hiles Lbr. Co., Crandon, Wis.	1	1	.....	.....	.....	.....
17	Forster-Mueller Co., Hiles, Wis.	1	.....	.....	1	.....	.....
28	Menomonee Bay Shore Lbr. Co., Wabeno, Wis.	1	1	.....	.....	.....	.....
June 19	Roddis Lumber Co., Park Falls, Wis.	2	1	1	.....	.....	.....
19	Mellen Lumber Co., Glidden, Wis.	1	1	.....	.....	.....	.....
20	Atwood Lumber Co., Park Falls, Wis.	7	.....	1	6	.....	.....
20	Foster-Latimer Lumber Co., Mellen, Wis.	2	1	1	.....	.....	.....
Aug. 29	Rib Lake Lumber Co.	4	2	.....	.....	.....	2
		24	7	4	11	.....	2

SUMMARY OF LOCOMOTIVE INSPECTION.

No.	locomotives examined	651	100%
"	in good condition	327	50%
"	in fair condition	145	22%
"	in bad condition	126	19%
"	in shop for repair	41	7%
"	ordered out of service	12	2%

County and Town Forests.

Chapter 77, laws of 1909, authorizes any town board to acquire by purchase or otherwise, a sufficient tract of land to use and maintain as a woodlot, and to preserve and reforest the same under regulations approved by the State Board of Forestry. It is estimated that in northern Wisconsin there are from twelve to thirteen million acres of wild and uncultivated land. Of this amount it is estimated that fully ten million acres are suitable for agriculture and will eventually be cultivated. This leaves, then, about three million acres of land in the twenty-two most northern counties of the state that are unfit for agriculture, and that must be depended upon to produce a large part of the future forest products of the state. It will probably be impossible for the state to ever acquire all of this land and place it under forestry management, and even if it could do so it would not be well for the state to attempt to own and manage many of the smaller and more isolated tracts of forest land. The state will have all it can do for many years to come to manage the large forest reserves upon the headwaters of the Wisconsin and

Chippewa rivers, and the counties and towns should acquire the smaller tracts.

This is a comparatively new idea in America, but in Germany, France, Norway, Sweden, Switzerland, and other European countries there are many communal forests and even city forests. These have almost universally proved most successful and in many instances the revenue from the communal forests has been sufficient to pay all taxes and to build splendid roads.

If the towns and counties in northern Wisconsin will gradually acquire the non-agricultural lands, at reasonable prices, and then place them under forestry management, they will find that they will secure an increasing revenue, provide work for many of their settlers during the winter months, and not only retain but add to the number of their small wood-using industries.

Closer Utilization of Forest Products.

The Forest Products Laboratory, located at Madison, Wisconsin, which is a branch of the United States Forest Service, is especially organized and equipped to study all the various problems connected with the closer utilization of forest products. The following summary of the report of Mr. H. S. Betts of the Laboratory force, illustrates only some of the chief results accomplished by the Laboratory along lines that are of especial interest to the wood users of Wisconsin.

WOOD PRESERVATION.

Conditions in Industry.

Number of railroad ties used for new track in 1910..	22,255,000
Number of railroad ties used for replacements in old tracks	125,976,000
Value of railroad ties used for replacements in old tracks	$64,200,000
Proportion of ties treated in 1910	20%
Annual saving possible by treating ties, poles, posts, piling, mine timbers, shingles, and lumber exposed to weather	
Material	6,000,000,000 bd. ft.
Value	$71,700,000

Problems of Industry.

(1) To bring the advantages of wood preservation to the attention of wood users.

(2) To determine the best methods of treating various woods.

(3) To determine the merits of various preservatives.

(4) To determine the best methods of operating various types of plants.

(5) To determine a method of rendering wood fireproof.

Work Done by Products.

(1) Tests to determine the life of both treated and untreated material are being carried on in coöperation with railway companies, cities (paving blocks), telephone companies, and mine companies. It has been shown that the life of wood used in exposed situations or in contact with the soil or water can be increased at least three times by treatment with preservatives. Forty-two sets of test material in various parts of the country are inspected at regular intervals by Products and the results published from time to time. Information of this sort shows definitely the saving in both material and money due to preservative treatment. In one instance the installation of a small treating plant by a coal company reduced their annual consumption of timber to one-half of the amount previously required, though only part of the timber used was treated.

(2) The Service has designed some twelve wood preserving plants for wood-using companies and assisted in the design and preliminary operation of many others. The industry is now well established. A large amount of information on the best methods of treating certain woods, of operating various types of plants, and of handling certain preservatives is being constantly supplied in reply to inquiries. In 1904 there were 30 plants in operation, while in 1910 there were 84. From 1909 to 1910 there was a gain of over 45 per cent in the quantity of material treated annually.

(3) Tests have shown that many woods of comparatively little value, such as loblolly pine of the Southeast, jack pine of the Northeast, and lodgepole pine of the Rocky Mountain states, can be easily treated with preservative and are suitable for ties. The use of these pines for tie purposes has doubled in the last five years.

(4) Tests have been made on 23 preservatives, including creosotes and salt solutions, to determine their properties, such as effectiveness in checking the growth of fungus, ability to penetrate into wood, effect on the strength of wood and permanency. As from 50 to 75 per cent of the cost of treating is for the preservative, accurate data to guide a selection are important. Such tests have shown the necessity of careful analysis and grading of the creosotes used as wood preservatives, and laboratories have been established by the largest water-gas tar company in the United States and by one of the largest creosote companies for the better handling of their wood preservatives.

(5) As a result of tests to show the possibilities of treated loblolly pine for pole construction a plant has been constructed in the South and is operating on this species.

(6) Tests to show the advantages of treating silo timber have resulted in silo companies furnishing treated material.

(7) The results of investigations of the treatment of paving blocks have been utilized by the city of Chicago in drawing up specifications for city pavements.

(8) The specifications for wood preservatives adopted by the American Railway Engineering and Maintenance of Way Association and by the National Electric Light Association are based on work done by Products in analyzing and grading preservatives.

(9) The methods of treating poles by the brush and open-tank process adopted by the National Electric Light Association are based on the recommendations of Products.

MECHANICAL TESTS OF WOOD.

Conditions in Building Trades.

Amount of wood used in 1910	20,000,000,000 bd. ft.
Value of wood used in 1910	$300,000,000

Problems of Industry.

(1) To determine the strength of woods commonly used for structural purposes and the effect of defects, such as knots, checks, and shakes, on the strength.

(2) To determine for comparative purpose the mechanical properties (strength, stiffness, hardness, toughness, shrinkage, swelling, etc.) of woods grown in the United States in the form of small, clear pieces.

(3) To show the relative strength of standard woods and proposed substitutes in the form in which they are used, such as boxes, spokes, axles, poles, mine timber, etc.

Work Done by Products.

(1) The grading rules for structural timber formulated by the American Railway Engineering and Maintenance of Way Association, and also the rules formulated by the American Society for Testing Materials, are based largely on the results of tests made by Products.

(2) The National Association of Hickory Manufacturers incorporated the results of a series of tests on red and white hick-

ory wagon spokes in their grading rules, allowing red hickory to appear in higher grades than before, thus making better use of material that was formerly considered inferior.

(3) The portion of the new building laws for New York City that relates to wooden construction is based largely on the results of Products tests.

(4) Tests made by Products on telephone poles of various species have shown that woods heretofore considered unsuitable have the requisite strength for pole purposes. The tests have resulted in the increased use of lodgepole pine and Engelmann spruce in the West as substitutes for the less plentiful and higher priced cedar.

(5) Formerly timbers cut from trees tapped for turpentine were thought to be weaker than timbers from untapped trees, and only unboxed timber was accepted. This discrimination has caused a waste of about thirty-seven billion board feet of longleaf pine timber, valued at $111,000,000. Tests made by the Forest Service have shown that tapping trees for turpentine has no effect on the strength, and the use of boxed timber is becoming general.

(6) Tests on packing boxes of various types, including boxes with and without battens, dove-tailed boxes, and wire-bound boxes, have shown wire-bound boxes to be the most economical form of construction. These results effect the use of some 4,000,000,000 bd. ft. of material. The tests have resulted in the revision of the specifications of the Interstate Commerce Commission for boxes used in shipping explosives.

(7) Tests on shortleaf pine and white cedar cross-arms in standard sizes have shown these species to possess ample strength for this purpose, as well as the commonly used species, Douglas fir and long leaf pine.

(8) Tests on California tanbark oak have shown it to be entirely suitable for many purposes for which eastern oak is used. Approximately 400,000,000 bd. ft. of tanbark oak have been left in the woods to decay after the bark was removed for tanning purposes. Tanbark oak flooring was used in one of the large hotels recently rebuilt in San Francisco.

(9) The practice of steaming timber before preservative treatment has been practically abandoned as a result of tests that showed the strong possibility of weakening the timber and also that air seasoning was preferable to steaming as a means of rendering timber more easily treated.

WOOD PULP.

Conditions of Industry.

Number of paper mills in the United States in 1909..	787
Value of products	$267,869,000
Wood used for pulp	4,000,000 cords
Annual sawmill waste suitable for pulp (Slabs and edgings)	5,000,000 cords

Year.	Proportion of spruce used.	Proportion of spruce imported.	Cost of spruce per cord.		Imports of pulp.	Exports of pulp.
			Domestic.	Imported.		
	per cent	per cent			Tons.	Tons
1900..	76	23	$4 80	$6 50	82,000	14,000
1909..	60	32	9 30	11 30	307,000	10,000

Problems of Industry.

(1) To find satisfactory substitutes for spruce.

(2) To determine the paper-making possibilities of species not now used.

(3) To find methods adapted to making paper from the waste of sawmills and other wood-using industries.

(4) To find methods of raising the yield and quality of pulp obtained in average practice.

Work Done by Products.

(1) Tests have shown that pulps of commercial value suitable for use in the manufacture of news and wrapping paper can be made by the sulphite process from eight species of native woods, several of which grow in large quantities on the National Forests. Some of these woods are now used to a limited extent, others not at all. Mills have started to use red fir, white fir, and lodgepole pine. Other species are under investigation.

(2) Tests have shown that three native species, jack pine, tamarack, and hemlock, of which large quantities are available in the Lake States, can be satisfactorily substituted for spruce in the ground-wood process in making the cheaper grades of paper such as news and wrapping. Several mills have begun grinding these woods. A number of western woods are now being tested.

(3) Tests have shown that pulps suitable for book or wrapping paper can be made from 12 new species of native woods by

the soda process; several other native species show commercial possibilities as soda pulpwoods. One mill that will operate on western yellow pine is in course of construction in the Southwest.

(4) Tests have shown that the highest grades of "Kraft" paper can be made from longleaf pine by the soda and sulphate processes. Three paper mills in the Southeast are now using longleaf pine, a fourth is under construction, and plans are under way for a fifth.

(5) A number of methods of increasing the yield of pulp from the raw material without decreasing the quality of the product have been found.

(6) Tests by the sulphate process, now little used in the United States, have shown especial possibilities as a means of making paper from mill waste. A number of mills are now operating on waste.

DRYING LUMBER.

Conditions of Industry.

Amount of lumber dried or seasoned before use 1911	30,000,000,000 bd. ft.
Proportion of waste in drying conifers	3%
Proportion of waste in drying hard woods	10%
Value of material wasted in drying	$21,375,000

Problems of Industry.

(1) To find methods of drying or seasoning lumber that will reduce the present waste.

Work Done by Products.

A kiln has been designed which has shown greater efficiency than is the case in average practice. A carload of water oak wagon felloes furnished by a large vehicle manufacturing company, and claimed by them to be of little value because they could not be seasoned without checking and warping, were dried with a loss of only 2 per cent of the material. A kiln of the new type has been constructed in coöperation with a California lumber manufacturing company, and another one is being built in coöperation with a hickory manufacturing company in Illinois.

WOOD DISTILLATION.

Conditions in Industry.

Wood used in 1910	1,452,000 cords
Value of raw materials	$4,728,000
Value of products	$9,600,000
Number of distillation plants	147

Wood for distillation is used in the form of cordwood, small pieces, and to some extent as sawdust. The products are acetate of lime, wood alcohol, turpentine, pine oils, and charcoal.

Problems of Industry.

(1) To investigate the possibilities of wood not used at present.
(2) To find methods of raising the yields and quality of the products.
(3) To find methods of using the waste from wood-using industries in distillation plants.
(4) To secure information that will make possible more uniform standards in grading wood distillation products.

Work Done by Products.

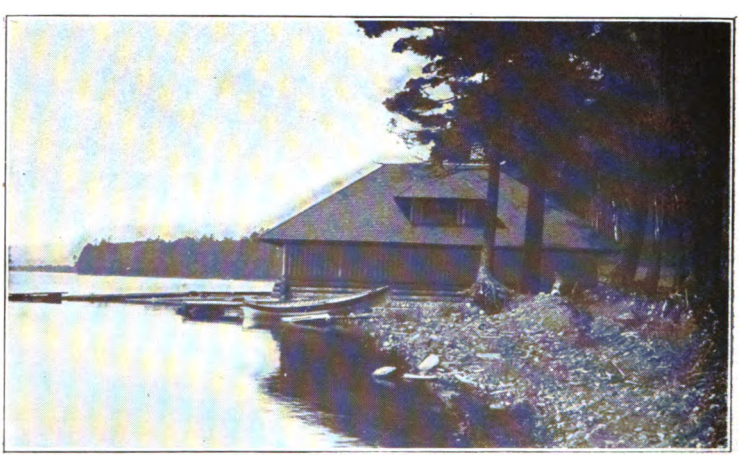
(1) In hardwood distillation over 90 per cent of the material used is beech, birch, and maple, and practically no attempt has been made to utilize other species. Tests made by Products have shown that commercial yields of acetate of lime and wood alcohol can be obtained from hickory, oak, tupelo, and red gum. Mill waste consisting of oak and red gum is now being used by at least one plant.

(2) Commercial methods used in hardwood distillation are generally crude and only part of the possible products are obtained. Tests have shown that it is possible to increase the yield of acetate of lime 50 per cent over present practice. This means a possible annual increase in the amount of acetate of lime produced from the same amount of raw material of over 38,000 tons.

(3) Steam distillation as an industry is still in an experimental stage. Methods of operation vary widely. The Service has made tests to show the effect of varying conditions in the steam distillation process on the yield and cost of operation. This information has been of service to operators in standardizing methods and raising the efficiency of their processes.

(4) The American Chemical Society, the American Society for Testing Materials, the Navy Department, and the Isthmian Canal Commission have used the results of tests made by Products in formulating specifications for wood turpentine.

HEADQUARTERS CAMP, STATE BOARD OF FORESTRY.
Headquarters of Field Instruction for Forest Ranger Students.



BOATHOUSE AT HEADQUARTERS CAMP.

STATE FOREST RESERVES.

Headquarters Camp and Ranger Cabins.

During the summer of 1911 a large Headquarters camp was built on Big Trout lake in Vilas county, and this is the headquarters of all the forestry work on the reserve, and also the location of the main forest nursery, which now contains some 2,500,000 young trees.

The main building is a large double house, made from peeled Norway pine logs cut near the site of the nursery. Norway pine logs were also used in the construction of the barn, boathouse, and the wood and ice house at the Camp. Views of all these buildings are shown in this report, and as will be noticed they are handsome, substantial buildings, which are very appropriate to their surroundings, and as the main forestry buildings on the reserve.

Four ranger cabins with barns, wood and ice houses and small bunk houses for laborers have been built at the following points:

Little Carr lake	in T. 38, R. 7 E.
Rest lake	in T. 42, R. 5 E.
Boulder Dam lake	in T. 42, R. 6 E.
Plum lake	in T. 41, R. 8 E.

During the winter of 1912–13 a ranger cabin is being built at Star lake in T. 41, R. 8 E., and one will probably be started at Carroll lake in T. 39, R. 7 E., and one will also be either built or purchased at Arbor Vitae in T. 40, R. 7 E.

It is planned to gradually furnish comfortable cabins for all the rangers, and small cabins must be built for the Federal patrolmen to occupy during dangerously dry seasons.

Mapping.

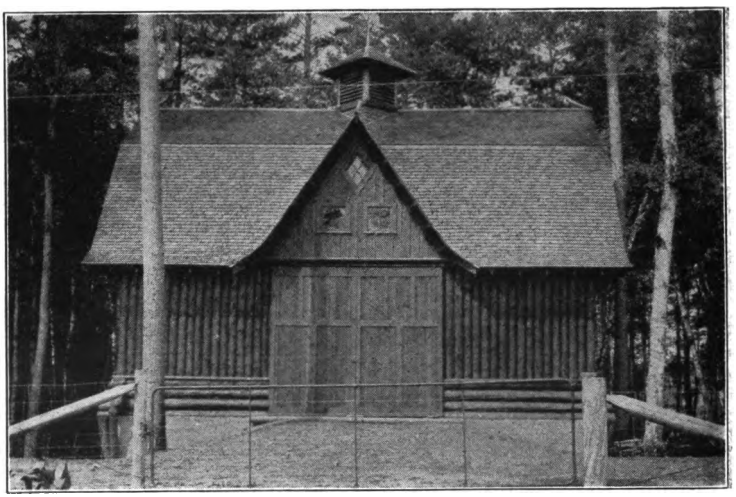
In the state forestry work and especially fire protection, the need of an approximately accurate map of the forest reserve

region was early felt and therefore during the field seasons of 1911 and 1912 the state forest rangers and cruisers, and also the Federal patrolmen, have been noting errors on the old map and also sending in to the Headquarters camp township plats upon which they have noted the location of all roads, fire lines, and telephone lines built within their districts. One of the forest rangers has used this mass of material in making a new map of the forest reserve area, and although it is not absolutely accurate in many of the minor details, still it is a great improvement over all previous maps and will be invaluable, especially to the lookout men in accurately locating forest fires. This map will be constantly corrected and added to, so that in the course of a few years we hope to have a map of the forest reserve area that will be a great aid in forestry management.

Soil Survey.

During the summer of 1910 at the request of the State Board of Forestry, the College of Agriculture of the University of Wisconsin made a careful soil survey of seven townships within the forest reserve area in Oneida and Vilas counties. The area covered included all of townships 38, 39 and 40, range 7 E., and portions of township 43, ranges 5, 6, 7 and 8 E., as it was thought that these townships were fairly typical and representative of the forest reserve area in these counties. This survey disclosed the fact that 78% of the total area examined was true forest land, more valuable for forestry than for agriculture, and that 22% was a loamy sand, which was classed as possible agricultural land. However, this 22% of possible agricultural land is not in a solid block, but is scattered through the seven townships of true forest land, and the Forestry board has felt that it would be a grave mistake to encourage settlers to locate on small tracts of doubtful agricultural value, where they would be surrounded for many miles on all sides by lands that were only suited to the growth of timber. If this were done they would be doomed to comparative isolation, and would be deprived of good schools and the many advantages of a growing community.

During the summer of 1912 the College of Agriculture continued the soil survey of the forest reserve, the following eight



BARN AT HEADQUARTERS CAMP.

townships being covered; township 41, ranges 6, 7, and 8 E., and township 42, ranges 4, 5, 6, 7 and 8 E. Following is the report of Mr. F. L. Musback, who had charge of the work under the direction of Professor A. R. Whitson, of the College of Agriculture.

Mr. E. M. GRIFFITH,
State Forester.

Dear Sir:—

I am sending you with this a brief preliminary report by Mr. F. L. Musback on the soils of a portion of Oneida and Iron counties. You understand that it is our purpose to ultimately complete the mapping of the soils of that whole region. Mr. Musback has this year finished the survey of his area of the northwestern part of the state and we are hoping, therefore, to be able to push the work in the north central section somewhat more rapidly during the next few years. In the meantime we hope this brief report on the areas in which you are now working will be of assistance to you in distinguishing between the agricultural and nonagricultural lands of that region.

While, as you know, I am in hearty sympathy with the efforts being made to develop a state forest reserve, it must be borne in mind that the mapping of the soils of this small area which have so far been covered does not form a basis for estimating the relative amounts of the different classes of soils with reference to their agricultural or nonagricultural value which will be found in other sections of that region.

Very truly yours,

A. R. WHITSON.

PRELIMINARY REPORT OF SOILS OF EIGHT TOWNSHIPS IN VILAS AND IRON COUNTIES.

These eight townships are located in Vilas and Iron counties (all but 42–4 are in Vilas county) and include a considerable portion of land within the so-called Forest Reserve. The work was begun in May, 1912, by the writer assisted by Mr. J. McDonald of the forestry department. At this time eight days were spent with horse and conveyance going over all the roads and trails that were passable. Long walking trips were taken where the trails were widely separated, or impassable. Some of these walking trips were along old railroad grades, fire lines, or trails that admitted only of travel on foot. Later in the fall another week, making a total of fifteen days actual work, was spent in the area. At this time more roads were opened so that considerable more area was accessible than earlier in the year. During the fifteen days approximately three hundred miles were covered including travel by horse, walking, and by means of launch and row boats, and an area of two hundred and seventy six (276) square miles was examined.

From the large tract covered in the short time the report is necessarily more of a general one and less specific in the matter of detail than would otherwise have been the case had more

time been spent. But with the many miles of good roads throughout the reserve and the assistance of a cruiser who was thoroughly familiar with the country, a very good general knowledge of the soil, surface features, and adaptability to agriculture of the eight townships above mentioned was obtained. It does not, however, furnish detailed information as to any particular 40 acre tract area, in this respect it differs from the work done by Mr. Bergh in 1910 who at that time spent nearly two months on an area of about equal size.

The Soil.

The soils in this section of the state are glacial in origin. This fact in itself is ground for wide variation often within short distances. In a general way the soils in the area under discussion fall under four groups which have quite marked differences both as to textural qualities and to topographic features. These four groups are as follows:

1—Sandy to sandy loam (pine land and mixed hardwood)
2—Jack pine sandy soil (Jack pine and Norway pine)
3—Sandy loam to loam (Mixed hardwood mainly)
4—Peat (Mainly open swamp land)

Sand to Sandy Loam.

This type embraces more than 50% of the area examined. The tract is practically all cut over pinery with isolated patches of hardwood, yellow birch, poplar, maple, scattered here and there throughout the area. The Norway pine, however, was the predominant species developed on this soil type.

The soil to a depth of eight (8) inches is a sandy to a sandy loam, of a brown to golden color and carrying a small amount of organic matter in surface one inch. Small fragments of stone and gravelly material are associated with this surface soil. Below eight inches the soil assumes more of a sandy texture, the color becomes lighter and more rock fragments and coarse gravel are mixed with it. These rock fragments are usually small and angular. Over surface good size boulders are frequently strewn. Occasionally boulders 10-12 feet in diameter are encountered. The surface features of this type are undulating and represent a typical morainic development. The hills for the most part are not over 40–50 feet in height,

though some are seventy-five (75) to one hundred (100) feet above the surrounding country, and extend in a succession of undulations of varying slope and shape. Lakes are common throughout the area. Along streams marsh tracts are frequently developed.

The agricultural possibilities of this soil are limited, chiefly on account of the rough topography. Tracts of one hundred (100) acres or more in extent are frequently found which are gently rolling or nearly level, and may be considered agricultural land, yet eighty-five (85) to ninety (90) per cent of this soil type cannot be considered of agricultural value.

Jack Pine Sandy Soil.

This soil is developed extensively throughout this area and embraces nearly 1/5 of the block examined. The land has a rather uniformly level topography and is often spoken of as Jack Pine Barrens or plains elsewhere. While the greater portion is generally level, more or less rolling tracts are also included in this general classification. This sandy soil area was timbered principally with Jack pine and Norway pine. In the finer textured soil poplar, white birch and some white pine developed. At present the larger portion is cut-over land, though some good stands of Norway and Jack Pines yet remain. Several areas of considerable extent were observed upon which a very sparse growth of timber developed. Sweet fern and brake are common.

In general the soil is made up principally of sand grains of varying size to a depth of 40″ and more. However, two rather distinct types may be described:—one is a fine sand carrying a small amount of gravelly material, and the other a coarser sand with which more gravel and rock fragments are associated. The fine sand has a pronounced dark brown color becoming lighter in color at lower depth. At surface a layer of gray sand one to two (1–2) inches deep is often developed. The vegetation is better developed on this soil type, for besides carrying larger proportion of fine earth, it also contains more organic material. About 1/3 of the area mapped as Jack Pine Sandy Soils is of this quality.

The coarse sand carries considerable amount of gravelly material below 12–14 inches. The surface eight to ten (8–10)

inches is also brown, with subsoil of grayish cast. Both types are generally free from stone though the finer sandy is found to be stony in small local areas.

The value of this soil type, agriculturally, depends on its proper management as well as to its physical condition and depth to ground water. Under ordinary management, much of this type, especially the coarse phase, cannot be made profitably productive. This is especially true when the depth to ground water is any considerable distance. The soil under proper management, however, produces good yields of potatoes, rye, oats, buckwheat, clover, truck crops, corn and beans.

Sandy Loam to Loam.

This type embraces about 15 per cent of the total area and is situated mainly in towns 41 and 42, R. 6 East. The type is also cut-over land. The soil to depth of eight (8) inches varies from sandy loam to loam followed by a subsoil which grades more into sandy material with some gravel. The color is grayish to a brown, becoming light colored at lower depths. Stoniness throughout soil mass is of frequent occurrence. The topographic features are rolling to slightly hilly. More nearly level tracts occur frequently.

The timber, nearly all cut now, consisted of mixed hardwoods and pines. Seventy-five to eighty per cent can be utilized for agricultural purposes. It is well suited for various grains and root crops, clover and alfalfa.

Peat.

The areas of peat in this section are either small isolated tracts that occur along stream bottoms, or tracts in one continuous body covering several thousand acres or more. The largest continuous tract is found in Townships 42, R. 4 and 5 East. These large tracts are usually open swamps with islands of wooded uplands scattered throughout. These islands are usually from a few rods to a mile or more in diameter. The smaller isolated tracts are covered with growths of spruce, tamarack and cedar.

The soil is largely composed of decomposed vegetable matter spoken of as "peat." It is of a dark brown color fairly well decomposed and underlain by a sandy subsoil at a depth ranging from 18–24 inches below the surface.

The value of this type of soil from an agricultural point of view is largely dependent upon the drainage possibilities. This phase of the problem was not studied except in a very general way. The Manitowish waters drain the greater portion of the open marshes above referred to, and include the Manitowish river, Bear creek, and their tributaries. Nearly all these have good fall, with the stream beds in many instances of sufficient depth to afford good outlets for drainage systems.

F. L. MUSBACK.

From the above report it will be noted that the land within the eight townships can be approximately classified as follows:

1. Sandy to sandy loam (forest land)	50%
2. Jack pine sandy soil (forest land)	20%
3. Sandy loam to loam (possible agricultural land)	15%
4. Peat (reservoir lands)	15%

The peat lands are in the low marshes and will be either largely overflowed by the reservoirs that are being built at the headwaters of the Wisconsin and Chippewa rivers, or used as natural reservoirs. The Federal government has reserved the right to overflow these lands and any prospective settler should look into this matter very carefully.

As will be noted from the above table the forest and reservoir lands cover about 85% of the entire area examined, and the 15% of possible agricultural lands are rather badly scattered, though not so widely as in the seven townships surveyed in 1910. Fifteen townships, or approximately 345,000 acres have been examined in 1910 and 1912 and from 78 to 85% can be classed as true forest land, which is not good agricultural soil and upon which settlers should not be encouraged to locate. Town and county officials and land companies are naturally loath to admit that any of their land is non-agricultural, and they are prone to charge foresters with discouraging settlement. But the tenets of forestry are that no land should be kept for forestry that is more valuable for agriculture, and certainly the Forestry board would be inclined to welcome settlers in the forest reserve as they would usually prove good workmen whose interests would be identical with those of the state.

But the Forestry board would be doing a great wrong to encourage any man to locate on an isolated tract of rather doubtful agricultural land in the heart of the forest reserve, for though the man might be willing, it would doom his wife and

children to a hard, lonely existence without the benefits of good schools or a growing community.

It is estimated that there are at least 13,000,000 acres of land in northern Wisconsin awaiting development, and much of it is the highest grade agricultural soil. Wisconsin is so rich in this natural resource, and the state has so much at stake in the prosperity and happiness of her settlers, that the state should direct such settlement into the proper channels. The amount of land within the state forest reserves that can possibly be classed as agricultural is a small percentage and in most cases is so badly scattered as to preclude settlement. The forest rangers will use a considerable portion of the areas that are possible agricultural land, but the state should not encourage any settlers to locate in this region.

It is an admitted fact that when the state buys large tracts for forest reserve purposes and thereby withdraws such lands from taxation, it should pay its fair share of the costs of schools and local government within the forest reserve area. But because the state should do this is no reason for condemning the Forestry board for purchasing lands to block up and consolidate the state forest reserves.

Surveying Lake Lots.

In order that the lake shores within the forest reserves should be platted to the best possible advantage for leasing as camp and cottage sites, it has been necessary to survey them, and one of the forest rangers has devoted most of his time to this work. All lots are of good size, usually with a lake frontage of from 300 to 500 feet, and containing from one acre up to five acres. The lake frontage owned by the state has been surveyed and platted on the following lakes: Tomahawk, Big Trout, Plum, Star and Palmer, and work is progressing on Rest, Clear and Carroll lakes.

Leasing Camp and Cottage Sites.

There are nearly 1200 lakes within the state forest reserve area and the fact that this wonderful lake region is being built up as a great forest reserve means not only that the beauty and attractiveness of these lakes will always be preserved, but also

A PRIVATE CAMP WITHIN THE FOREST RESERVE AREA.

that the forests will be protected and greatly improved, that hundreds of miles of roads, fire lines, trails and telephone lines will be built, and that this region will be made safe from forest fires. Already the main part of this work has been done, and the work will be continued from year to year until the reserves are placed in the best possible condition.

Hunting and fishing in this region will also constantly improve for many years to come, and for these several reasons the forest reserves are going to be very attractive for summer camps and cottages.

The reserves are of course intended for the fullest use and enjoyment of all the people, and therefore the State Board of Forestry has adopted the policy of leasing camp and cottage sites on the lakes and rivers. The following circular prepared by the Department explains the general terms under which leases are granted.

DEAR SIR:

In response to many inquiries in regard to the leasing of camp and cottage sites on lakes within the state forest reserve, the following general information is given.

The forest reserve area, especially in Vilas county and the northern portion of Oneida county, includes hundreds of beautiful lakes and the state owns many of the most desirable lots on those lakes. The state board of forestry is prepared to lease five acres or more to any individual or club for a period of from one to twenty years, with privilege of renewal, as sites for summer camps or cottages, at an annual rental of from $10 to $50, depending upon the location, area and value, upon which suitable buildings are to be erected by the lessee.

Sites can be had either near a railroad or distant from one, and applicants should state which they prefer; and whether they desire a site suitably located for a family outing or whether they simply require good hunting and fishing. These lands are wild and forest lands and not suited for agriculture. Application should be made to the State Forester, giving full and definite information as to the requirements of the applicant.

The provisions of the lease are very simple and not at all restrictive, the main points being that no green timber shall be cut for building or other purposes without the consent of the State Forester, that all reasonable care shall be taken to prevent starting forest fires and that no intoxicating liquors will be sold.

Individuals or families who would like to spend the summer in the forest reserves can secure a site for the erection of tents or temporary structures upon the payment of a yearly fee of $2.00 for an individual and $5.00 for a family. Detailed information as to any particular lake, also camp, cottage or tenting sites, will be furnished upon application.

The state forest rangers, in connection with their work, will try to protect camps and cottages on state land from being molested.

A map showing the most desirable lake lots can usually be loaned to applicants, and it should be returned as promptly as possible.

Very respectfully,

E. M. GRIFFITH,
State Forester.

Congress has now granted to Wisconsin for forestry purposes some 250 islands in the inland lakes, most of these being within the forest reserve area, and these islands will be leased exactly the same as the lake shore property.

GRANT OF ISLANDS FROM THE GOVERNMENT.

Due to the untiring efforts of Congressman E. A. Morse, in the House of Representatives, and Senator La Follette in the Senate, the U. S. Congress on August 22nd, 1912, granted to Wisconsin all the unsurveyed and unallotted islands in inland lakes, north of town 33. The islands are granted to Wisconsin as an addition to the state forest reserves, and the act provides that they must always be managed as part of the reserves, or will revert to the United States.

Before this grant a large number of islands had been acquired by private parties, and in many cases they had cut off all the timber leaving the islands eyesores, instead of the beauty spots that nature intended them to be.

The government did not have an accurate record of the number of islands in the inland lakes, but the reports of the state forest rangers show that that there are about 250 islands, and that they contain all the way from ¾ of an acre up to 40 acres each. During the winter of 1912–13 it is planned to have all these islands carefully surveyed and described, and they will then be leased for summer camps and cottages in exactly the same way that lake shore property within the forest reserves is leased by the state.

Wisconsin is extremely fortunate in securing such a large number of beautiful islands and they will greatly enhance the beauty and value of the forest reserves.

PROPOSED GAME PRESERVE.

It is proposed to fence in some 8,000 to 10,000 acres of land in 41–7 E., within the heart of the state forest reserves, as a game preserve, and to inclose within this preserve elk, moose, deer, pheasants, grouse and such fur bearing animals as beaver, mink, otter, and so forth.

The state already owns the land that it is proposed to enclose, and the government is prepared to give the state elk from the big herd that winters in Jackson's Hole, Montana, and in which many of the animals die each year on account of the lack of feed.

Some game enthusiasts have also offered to assist the state in securing some moose and a gentleman will give a large number

of Mongolian pheasants. Native deer can readily be driven into the game preserve, and the fur bearing animals can be secured within the state.

It is also proposed to use the game preserve, and possibly large marshes within the forest reserve, as a wild fowl refuge, where migratory birds will have a chance to breed without being slaughtered.

Mr. Edward A. McIlhenny, of New Orleans has established some splendid wild fowl refuges on the coast near New Orleans, and largely through his efforts, Mrs. Russell Sage of New York has recently purchased Marsh Island, near New Orleans, and has presented it to the government to be held for all time as a wild fowl refuge.

Mr. McIlhenny is a true sportsman who is working to preserve the wild bird life of America, and he is meeting with great success in his efforts to have all the states along the Mississippi river set aside wild fowl refuges so that the birds in their flights may find protective areas from New Orleans to the Canadian line.

The main idea of the proposed game preserve near Big Trout lake, in 41–7 E., is to protect the elk and moose until they increase to sufficient numbers so that some of them can be set free within the forest reserves in Vilas county and to then ask the legislature to prohibit the killing of any elk or moose for a number of years. In this way it will prove possible in a few years to again have these splendid game animals in Wisconsin, and the deer within the preserve should increase so rapidly that a number of them could be liberated each year.

The game birds will of course fly from the fenced area to other parts of the forest reserve, but they will very quickly learn where they are not shot, and will return to the preserve during the breeding season or when shot at frequently.

The fur bearing animals should gradually be distributed through all the lakes and streams of the forest reserve, and their taking carefully regulated so that they will not again be nearly totally destroyed.

Such a game preserve is the only feasible way of stocking the forest reserve with the game which it should contain, and now that the state owns the land, the chief cost will be the fencing and that can be purchased for about $100 per mile.

Forestry Work for Convalescent Consumptives.

The state forest reserves, comprising some 400,000 acres, and lying within the wonderful lake region of northern Wisconsin, should be used and enjoyed to the fullest extent by all the people of the state, and one of the best possible uses to which a portion of the reserves can be put is as a big outdoor sanatorium for convalescent consumptives and those who are threatened with the disease. The State Board of Forestry now has one large forest nursery containing some 2,500,000 tree seedlings, and within a year or two other nurseries will be built, so that probably the annual production of the nurseries will be about 2,000,000 seedlings, which will be nearly sufficient to reforest 2,000 acres a year.

Work both in a forest nursery, and in planting the seedlings, is light work which can be arranged so that it would be especially suited to the weakened condition of a convalescent consumptive patient. It is proposed to ask the legislature for an appropriation of $5,000 per year which would cover the cost of building and keeping in repair the wooden shacks in which the patients would live, and also the salaries of a doctor and nurse. The State Board of Forestry would set aside the land required for the sanatorium, forest nurseries and tracts to be reforested, and would pay the patients for the time in which they were actually employed in working for the state.

At first a patient might not be able to work more than four hours a day, but at 15c per hour, he would have earned 60c, or more than his board for one day would cost, and all that he earned over and above the cost of his board, would be credited to him, so that when cured he could leave the sanatorium with at least a small amount of money to start life anew.

This is not an absolutely untried plan, for as early as 1902, J. T. Rothrock, who for many years was commissioner of forestry in Pennsylvania, started a camp for consumptives at Mont Alto, in the forest reserve. Mr. Rothrock writes as follows in regard to the results that were accomplished in this camp:

"It was simply a camp—rough board shacks, costing from $40 to $60 apiece. The inmates provided their bedding, furniture, and prepared their own food. It continued so for nearly four years, receiving from the State $23,000, and from friends about $3,000. Meanwhile we had built some better cabins at a cost of $250 apiece, and erected an assembly hall.

"For the last few months we were able to begin feeding the patients from the state appropriation. June 1, 1907, the camp, at the request of the Forestry

Department, was transferred to the newly created State Health Department. Liberal appropriations were made for its support, and there is now on that ground a tuberculosis sanatorium, having at present 850 patients. Before we had time to work out the plan of forest planting, etc., thoroughly, the change was made, though we had tried the plan of small individual gardens for the patients, with great success. It was natural that I should try to find some avenue along which I could lead these people into light out-door work in forestry.

"You ask what obstacles were encountered during our five years of work on the camp idea. I reply none, inherent in the plan. I am anxious to impress one thing,—*It is cheaper, wiser, more humane, to prevent disease than it is to cure it,* and I think we begin our work at the wrong end. There are in Wisconsin, as in Pennsylvania, thousands of overworked, underpaid, underfed people, who are wearing out their lives in unsanitary surroundings, living to propagate a weaker generation, and then themselves die charges upon the tax or bounty of the community. Would it not be better from every point of view to get those people out camping, when just a little ailing, before they become sick? We are commencing to think so here in Pennsylvania, and are working to revive the camp idea to keep weak ones from becoming sick ones. I hope you progressive people in Wisconsin will keep everlastingly at this camp business in one form or another, or if need be, in several forms."

Mr. Rothrock does not take the credit that is due him for the really remarkable success of this camp, for in the nearly five years of its operation, over 75 per cent of those who came to the camp afflicted with tuberculosis, were discharged either cured or with the disease arrested.

As will be seen, Wisconsin is not blazing an entirely new trail, and yet the proposed plan in Wisconsin is fundamentally different from the Pennsylvania camp in the following important respects:

1. The plan in Wisconsin is to accept in the camp only convalescent patients, or those who are threatened with the disease.

2. The state will build and furnish the necessary shacks and will also feed all the patients.

3. Work will be provided for all the patients either in the forest nurseries, planting or some other form of light forestry work.

Wisconsin has a splendidly equipped sanatorium for consumptives at Wales, but Dr. Coon, the Superintendent, as well as other doctors of the state, finds that the hardest problem is to find light out-door work for the convalescent patient. Many of these are men and women from the larger cities, who on account of their very slender means are obliged to return at once to their work in the factory or store, and the long hours, combined with lack of fresh air, frequently result in a serious relapse, and sometimes death. For these reasons the doctors have welcomed enthusiastically the plan of giving these convalescents a few months at least of steady out-door life on the forest reserves, combined with light and pleasant work.

Some patients will undoubtedly find that in order to avoid a relapse they must continue to live in the cool dry climate of northern Wisconsin, and in such cases the State Board of For-

estry could lease to them at very reasonable rates, small tracts of arable land near the public resorts, hotels and private camps, and the patients would find that they would have a ready sale at good prices for all their vegetables, milk, chickens, etc. There are also thousands of men and women workers in Wisconsin, who though not consumptives, are so run down and worn out that they are an easy prey to the disease. It is a good sound policy for the state to aid such people in regaining their health, and thus avoid their becoming public charges, and the state could well afford to allow them to build camps on many portions of the forest reserves, and also to give them work in reforestation to a very considerable extent.

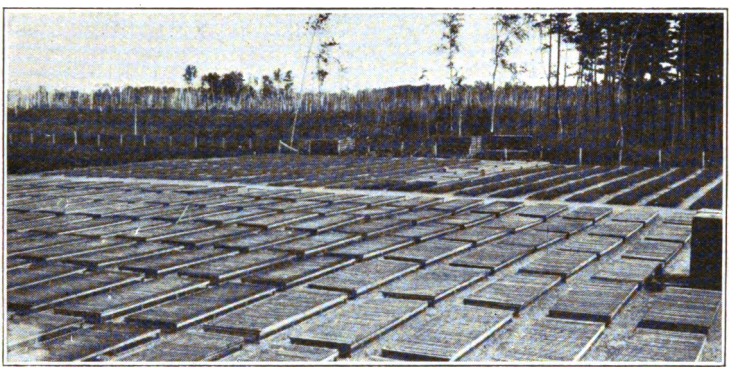
As a few months' out-door life in the bracing climate of northern Wisconsin will often make certain the complete cure of the convalescent consumptive, and also ward off possible consumption from the weak and debilitated worker, and as the state must reforest its denuded lands which are unfit for agriculture, it would seem both a sane and humane policy to give the patient a chance to do the work for which he is so suited, bringing to him health, and to the state wealth, through the forests that will be grown.

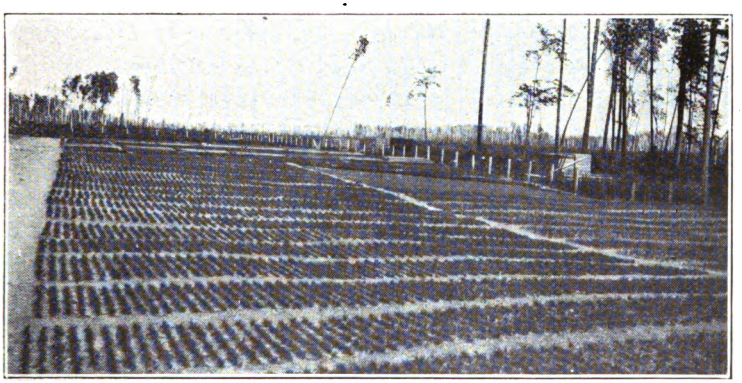
Forest Nurseries.

Where there have not been severe repeated forest fires within the forest reserve region, the second growth and natural reproduction are in most cases fairly satisfactory so that little if any planting will be necessary, but on some areas the fires were so severe that all the young growth of any real value was destroyed and of course in such cases planting is the only remedy. It would be far too expensive to purchase planting material from commercial nurseries, and therefore in the spring of 1911 a large nursery was started at the Headquarters camp at Trout lake, Vilas county, under the direct supervision of F. B. Moody, Assistant State Forester, and the results from the start have been remarkably successful, and the plants have been raised at an unusually low cost as will be noted from the following table.

1 YEAR SEEDLINGS.

	Number	Cost to raise per M.
White pine	632,000	$.46
Scotch pine	190,000	.45
Western yellow pine	60,000	.55
Norway spruce	11,000	1.06
Colorado blue spruce	40,000	.40
European larch	400	.88





VIEWS OF STATE NURSERY AT TROUT LAKE.

Young pine must be grown in the nursery for two years before being planted. About 2,500,000 seedlings are now being grown.

2 YEAR SEEDLINGS.

	Number	Cost to raise per M.
White pine	436,000	$.47
Norway pine	576,000	.47
Scotch pine	145,000	.46
Western yellow pine	13,000	.56
Norway spruce	20,000	1.07

2 YEAR TRANSPLANTS.

	Number	Cost to raise per M.
White pine	21,000	$1.25
Scotch pine	20,000	1.24
Western yellow pine	68,000	1.33

The above figures represent the actual cost of raising the plants, including all labor, but do not include the cost of land, clearing, water system, fencing, fertilizer, etc. The exact amount that must be added to cover all such expenses, depreciation, etc., cannot be determined until the plants are ready for planting but it will probably be about an annual charge of 15 cents per thousand plants. It is expected that the Trout lake nursery will raise from 1,250,000 to 1,500,000 trees each year and this number will be sufficient to reforest from 1,000 to 1,200 acres annually. So far very little trouble has been experienced in raising trees in this nursery. Damping off, a fungus disease which attacks young conifers the first season, has killed some of the seedlings, but has not been at all serious. The disease was cured by frequent watering and also scattering powdered sulphur over the seedlings. Grasshoppers killed some of the two year old white pine during the summer of 1912 by eating the bark and often girdling the young trees. There seemed to be no remedy to check this loss except screening the beds.

The ground has already been cleared for a forest nursery which will be started in the spring of 1913 at the Tomahawk lake ranger station. This nursery will contain from 3 to 3½ acres and should have an annual output of from 500,000 to 750,000 trees. In addition to these two large nurseries it is intended to establish smaller nurseries at all the other ranger stations.

It is the intention of the State Board of Forestry to sell trees, at slightly above cost, to citizens of Wisconsin who may wish to reforest their non-agricultural lands within the state.

Forest Planting.

The first plantations on the forest reserve were made in the spring of 1911 and as the state had no plant material of its own it was necessary to purchase all the stock used. As the plants were poorly packed and were ten days on the road, the losses were much greater than they would be under normal conditions.

The following species were planted in 1911 along the northeast shore of Trout lake:

White pine	181,200
Norway pine	1,000
Western yellow pine	5,000
Norway spruce	5,000

The western yellow pine were an experiment, but have done remarkably well, the plants being very strong and stocky, and it seems quite likely that this species may prove very valuable for reforesting the cut-over and burned lands within the forest reserves.

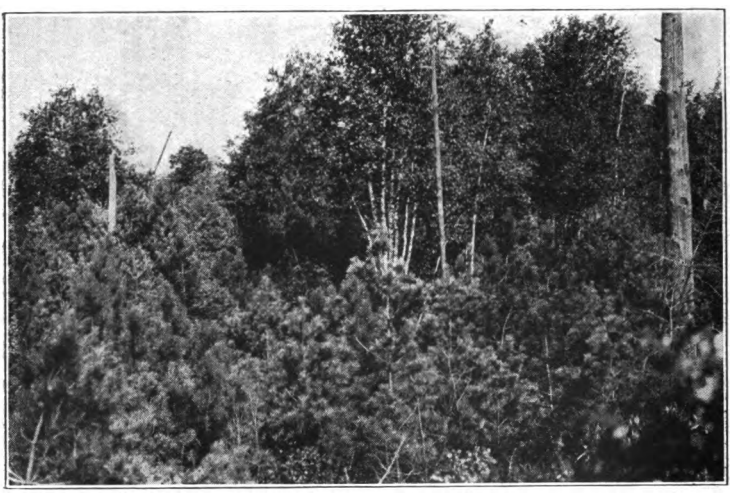
In the Trout lake forest nursery we now have over 140,000 plants of this species, so that within the next five years we can test it thoroughly.

During the spring of 1912 some 18,000 Scotch pine were planted at Trout lake, and as the plants were in good condition the losses were very small. This species has proved very successful in Michigan where it has been planted on sandy soil similar to that at Trout lake, so that it is not an experiment, but we want to compare its growth, freedom from disease, etc., in northern Wisconsin with that of white, Norway and western yellow pine, and even jack pine.

In order to have a fairly large and permanent experimental plantation it is proposed to reforest, in the spring of 1913, a long point in Star lake, Vilas county, which contains about 100 acres, and the following plants grown in the state nursery will be used:

White pine	50,000
Norway pine	50,000
Western yellow pine	10,000
Scotch pine	5,000
Norway spruce	5,000

A permanent accurate record of this plantation will be kept and it should prove a very valuable guide to all future tree planters of northern Wisconsin.



NATURAL PRODUCTION OF YOUNG PINE.

Where fires are kept out forest reproduction quickly occurs.

Throughout the forest reserves the first areas to be planted will be the lake shores where they have been cut over and burned, for in their present condition they are eyesores and should be reforested as soon as possible.

Natural Reproduction.

As stated in the report of the State Forester for 1907–08:

Natural reproduction, especially of pine, on the cut-over lands of northern Wisconsin is surprisingly good where forest fires have not run, but unfortunately such sections are the exception rather than the rule, and the fires of 1908 have destroyed thousands of acres of the most promising young growth. It may be said in general that over large areas natural reproduction is not complete, that is, there are blanks which have not restocked and which must be planted artificially in order to get an even stand, but every acre naturally reforested is a direct saving in time, labor, and money.

The value of such young growth together with the loss of soil fertility has led this office to repeatedly warn settlers in northern Wisconsin of the enormous annual loss caused by surface fires which they were apt to look upon as of little or no consequence. A great deal more attention is paid to such fires than in the past, but still there are even some town boards who object to fire wardens "wasting time and money" in putting out fires which are burning on cut-over lands, and such men seem to think that no damage is being done unless merchantable timber is being destroyed. Each year thousands of acres of not only pine seedlings, but also young timber which has been growing for from ten to twenty years is burned over and is a total loss, and there is nothing which can be cut and saved, as is the case with merchantable timber. The value of young growth is none the less real because it is prospective, and if Wisconsin is to have forests in the future, together with the industries dependent upon them, the forest fire problem must be solved so that the new forests with which nature is trying to reclothe the cut-over and barren lands will be carefully protected.

Since the above was written the forest fires of 1910 burned over 892,000 acres, and as a result an enormous amount of promising young timber was destroyed. Fortunately both 1911 and 1912 have been wet seasons with very little damage from forest

fires, but dry years will certainly come again, and the future wealth of the state absolutely depends on the protection of the young growing trees.

On the state forest reserves the Forestry board employs forest rangers whose duty it is to promptly detect and extinguish all forest fires and this has been made possible by a very complete fire protection system. Where severe repeated forest fires in the past have not destroyed all of the seed, the young pines are coming up, but where there is no pine or other valuable species, it will be necessary to plant.

It cannot be too strongly stated or frequently repeated that pine will always follow pine if the lands are not too severely burned over. But where all the pine seed has been killed by fires that burned deep into the soil, then Nature steps in and the light seed of the popple is carried upon the land from long distances. The popple is a fire seed, which Nature uses to quickly reclothe burned over soil, and it serves admirably as a shelterwood for more valuable species, especially pine, which is frequently found growing up under it.

The natural reproduction of the forest lands of northern Wisconsin is simply a question of adequate fire protection, and it is felt that the necessary protection can never be secured until a well organized system of forest fire patrols has been provided for each and every forest region in Wisconsin.

Fire Protective System.

In 1910 there were only a few roads within the state forest reserve and as a complete system of roads, fire lines and telephone lines was absolutely necessary in order to protect the reserve from forest fires, this work has been pushed as rapidly as the men and funds at the disposal of the forestry board would permit.

During the field seasons of 1911 and 1912 we have completed 159½ miles of road, 118 miles of fire lines and 56 miles of telephone lines, and it is believed that this is a greater amount of permanent protective work than has been accomplished by any other state in an equal length of time.

Road Building.

Within the forest reserve there were fortunately many miles of old logging railroad grades and with a comparatively small

BUILDING A ROAD AND FIRE LINE IN THE FOREST RESERVE.

amount of work these have been made into very fair wood roads, and they will prove excellent fire lines as well. The state will save thousands of dollars by being able to utilize these old railroad grades, and although many of them are so located that they cannot be used as roads, still most of them will be cleared of brush and other inflammable material and used as fire lines.

In 1911 approximately 108 miles of road were built, and 51 miles in 1912, at a cost of about $118 per mile.

Naturally the cost of road construction varies very greatly where in one case an old railroad grade can be utilized, while in another the road must be built through heavy brush or timber. The cost of construction under varying conditions is shown in the following typical cases:

Road and fire line built on an old railroad grade from Star lake to Camp 12. Distance 8 miles.

Character of work.	*Total Cost.*	*Cost per mile.*
Cutting brush	$56.85	$7.10
Removing ties	58.08	7.26
Removing rock and sod	9.20	1.15
Plowing and dragging	49.85	6.23
Board of men	85.90	10.73
Board of team	33.40	4.17
Total	$293.28	$36.64

On most of these old railroad grades the brush is very thick. This must first of all be cut out to make a good wide road, then piled and later on burned. The heaviest part of the work is removing the ties, which are often heavy birch trees which have become firmly imbedded in the turf. The ties are piled up along the road and when thoroughly dry are burned. After the rock and sod have been removed, the road is plowed and dragged and then with a little use the road packs firmly and becomes a very useful highway as well as an excellent fire line.

It will be noted that the cost of building the above road on an old railroad grade was $36.64 per mile, and it is interesting to compare the cost of the following road which was built through very brushy country, especially as the work was done under the same forest ranger with practically the same crew of men:

Portion of the road from Star lake to Sayner. Distance 2¾ miles.

Character of work.	*Total cost.*	*Cost per mile.*
Cutting brush	$113.95	$41.44
Removing stumps	44.85	16.31
Plowing and dragging	32.20	11.71
Scraping	70.05	25.47
Shovelling and grubbing	125.70	45.71
Dynamiting	19.00	6.91
Burning brush	26.45	9.62
Board of men	215.30	78.29
Board of team	86.95	31.62
Total	$734.45	$267.08

As a road from Star Lake to Sayner was badly needed, and as it will be very generally used by the public, more time and money was spent on it than would usually be the case.

However, probably every railroad grade which has been utilized in making a road has saved the state at least $150 per mile.

Fire Line Construction.

During 1911 and 1912 approximately 118 miles of fire lines have been constructed, of which 94 miles were built in 1911 and 24 miles in 1912, at an average cost of $87.70 per mile.

The greater part of the fire lines follow the old railroad grades and many of these are really secondary roads and can be used as such when desirable.

However in a good many places it has been found necessary to construct fire lines where there were no railroad grades, and in such cases the fire line has always been built so as to connect two lakes, or one lake with a river, road or other boundary from which the fire could be fought and checked.

The forest reserve contains several hundred lakes, besides a number of rivers and many smaller streams, which makes it a comparatively easy matter to divide the reserve by means of roads and fire lines, into a large number of blocks or districts, so that a forest fire can be held in the district in which it starts.

Telephone Construction.

In 1911 and 1912 there were constructed 56 miles of telephone line at an average cost of $36.77 per mile. The detailed cost of an average line is as follows:

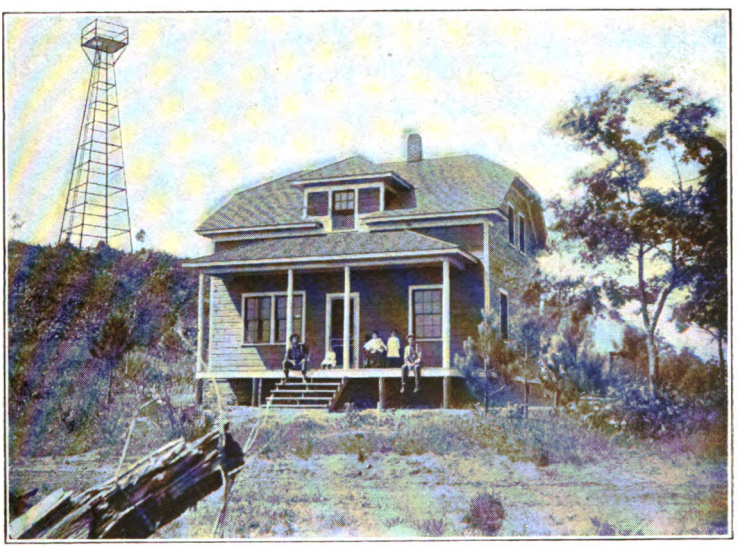
Cost of telephone line from Headquarters camp, Trout lake, to Sayner. Distance 9 miles.

Character of work.	*Total cost.*	*Cost per mile.*
Cutting and skidding poles to road	$78.30	$8.70
Digging holes, hauling and setting poles	75.60	8.40
Stumpage value of poles	40.50	4.50
Stringing wire	49.12	5.46
Cost of wire	43.38	4.82
Cost of knobs	2.70	.30
Cost of nails	.54	.06
Total	$290.14	$32.24

The telephone lines extend from Headquarters camp to the ranger cabins, lookout towers, and nearest towns, and a switchboard at Headquarters camp makes it possible to connect any of the lines.

LOGGING ROAD CONVERTED INTO A FIRE LINE.

An old logging road may be thus converted into a fire line for forest protection.



RANGER CABIN WITH LOOKOUT TOWER.

By triangulation methods, the location of a fire may be quickly and accurately determined for any point within the forest reserves.

Steel Lookout Towers.

During the summer of 1912 four 55 foot steel lookout towers have been built on some of the highest hills within the forest reserve, and these towers are so located that nearly the entire area of forest reserve lands in Oneida and Vilas counties can be observed from them.

The average cost of the towers has been $136.90, the detailed cost of a typical tower being as follows:

Cost of tower	$66.32
Labor setting up tower	52.51
Cement for foundations	9.55
Lumber for platform	3.05
Total	$131.43

From all the towers the country can be seen for 10 miles in almost any direction, and during dangerously dry weather the observers report immediately, by telephone, any fire or smoke that may be seen.

Cutting Old Stubs.

Old dead stubs are one of the most prolific means of spreading forest fires, as the fire quickly runs up the dead bark to the top of the tree and a slight wind will carry the burning bark for long distances. During 1911 and 1912 old stubs, chiefly birch, were cut back for 6 rods on each side of 83 miles of roads and fire lines, at an average cost of $5.34 per mile. With these old stubs out of the way there will be little probability, in many sections of the reserve, of a forest fire jumping over the road or fire line.

Slash Burning.

Where the slash from old lumbering operations is very heavy, and especially where it adjoins timber or other valuable property, it is necessary to pile and burn it so that it shall not be a constant menace to the forest reserve. During 1911 over 1200 acres of dangerous slashings were destroyed, and 135 acres in 1912, at an average cost of $4.88 per acre. The reason the cost was so heavy was on acount of the work being done on the worst areas where the slashings were heaviest, and also because the lumbermen had made no attempt to pile the slash and therefore it all had to be rehandled.

Portable Telephones.

After two years of experimenting the Western Electric company has perfected a portable telephone for the use of forest rangers and patrols, and two of these instruments have been tested on the telephone lines of the state forest reserves. It is a beautifully made instrument, packed in a leather case, which is easily carried on the ranger's back or fastened to a saddle. A ranger will often find a fire that is near a telephone line though it may be several miles to the nearest camp where there is a telephone instrument. We will suppose that the ranger finds the fire burning in some old slashings, and that he sees that he cannot extinguish it alone, but must have three or four men with axes, shovels and collapsible canvas water buckets. If he had to go several miles to the nearest camp in order to telephone for the men, he would lose much valuable time. Equipped with a portable telephone he goes to the nearest telephone line and gets the connection by simply throwing a heavy cord, which is weighted, over the line, and by sticking a steel rod into the ground. He then rings up the nearest ranger, or the Headquarters camp, reports just where the fire is, and help is rushed to him by horses or railway speeders. The ranger then goes back to the fire and works to keep it from spreading until help arrives.

It will thus be seen that the portable telephone is another important cog in the system of forest fire prevention and control, and that it is the ranger's fire alarm box. First, prevention, and second, promptness in getting well equipped fire fighters to the fire, are the problems in the big forest just as they are in the big city.

Forest Rangers' Fire Fighting Equipment.

The state forest reserves have been divided into districts with a forest ranger in charge of the work in each district. As is fully explained in this report the fire protective system consists of roads, fire lines, trails, lookout towers and telephone lines, but occasional fires will always occur, and the rangers must be properly equipped to fight and extinguish them.

At each ranger cabin there is a supply of fire fighting tools such as axes, shovels, water pails, and so forth, and at all the chief railroad stations within the forest reserve area there are

big tool boxes, fully equipped and ready to be shipped to any point along the line at a moment's notice.

The rangers must get to a fire with the least possible delay and therefore those who are located near a railroad line have railroad speeders and the other men have horses.

Field glasses for detecting small fires at a considerable distance, and portable telephones for quickly summoning help, have both proved very useful, and the men on the lookout towers will be equipped with telescopes, as they can then detect fires over a wide range of territory.

The ranger is also furnished with an ax, shovel and collapsible canvas water bucket, which he can carry on his railroad speeder or pack on his horse.

Federal and State Fire Protective Work.

Congress under the provisions of the Weeks law authorized the U. S. Department of Agriculture to coöperate with the various states in protecting timberlands upon the headquarters of navigable streams from forest fires. The act provides however that no part of the appropriation shall be used in any state that has not established a forest fire patrol system of its own and therefore only a few states were able to qualify.

Wisconsin's application for assistance in protecting the headwaters of the Wisconsin and Chippewa rivers was approved by the U. S. Forest Service and during the fire seasons of both 1911 and 1912 the Wisconsin State Board of Forestry has been allowed $5,000 with which to employ Federal patrolmen.

Each year from about May 1st to December 1st twelve Federal patrolmen are employed to assist an equal number of forest rangers who are in the permanent employ of the state.

During the fire season of 1911 there was so much rain that it was not necessary for the men to devote much of their time to patrol work, and therefore it was possible to make a great deal of headway in starting the fire protective system. Following is a somewhat detailed report of the results of the work in 1912:

Fortunately, during the summer of 1912, there was plenty of rain in Wisconsin, and it was so well distributed that there was very little danger from forest fires, except during June, and the first part of July. During those six weeks there were from ten to twelve small fires on the protective area, but they were quickly found and extinguished. The well distributed rains made it possible for the forest rangers and patrolmen to devote a large

share of their time to building up the protective system with the result that the following work was accomplished:

Miles new road built	49½
Miles new fire lines built	31
Miles old roads dragged or plowed	41
Miles old fire lines widened or cleaned	21
Miles new telephone lines constructed	16½
Miles old telephone lines repaired	15
Miles new trails made	11
Acres of slashings burned	615
Acres of clearing done	18
Lookout towers constructed	4
Bridges built	5

We now have 159½ miles of road completed, 118 miles of fire lines, 56 miles telephone lines, with connections from Headquarters camp to rangers' cabins, lookout towers and nearest towns. We have completed four ranger cabins, and have two more under construction.

Patrol Work.

Twelve state forest rangers, twelve federal patrolmen, and one private patrolman have been engaged in the patrol work during 1912. When not engaged in patrol work the men were employed in building up the protective system as outlined above.

The few settlers within the protective area, as well as the large number of summer visitors, have come to realize quite clearly the value of the patrol system, and are much more careful in burning brush and about leaving their camp fires burning.

There has been a marked improvement in this respect since 1911, and those living in, or using the protective area for camping, hunting, or fishing have been requested by means of notices, to help in preventing forest fires. Each ranger and patrolman has made it a point to call on each settler or camper in his district to inform him as to the law in regard to forest fires, and to enlist his support.

Lookout Work.

No lookout towers were built in 1911, but during 1912 four have been constructed. They are all 55 foot steel towers, which are connected by telephone with the Headquarters camp, ranger cabins and nearest towns, and which are so located that nearly all of the protective area can be observed from some one of the four towers. During June and the first part of July, patrolmen were assigned to duty in these towers from time to time, but during the remainder of the season there has been so much rain that lookout duty has not been necessary.

Fire Fighting.

During June and July there were only from ten to twelve fires on the protective area, and none after that until two fires occurred in November. All of these were small fires, which were quickly extinguished by the rangers and patrolmen, without the necessity of hiring any extra help. The expenditures in 1912 for the patrol and protective work during the time that the Federal patrolmen were employed was as follows:

State expenditures, approximately	$16,326.00
Federal expenditures, approximately	4,422.00
Total	$20,748.00

The Federal expenditures were only for the salaries of the Federal patrolmen, while the state expenditures covered the salaries of the forest rangers together with the cost of building roads, fire lines, trails, telephone lines and lookout towers. One private owner paid the salary of a patrolman throughout the entire fire season, and it is expected that by 1913 a number of other private owners and large timberland owners will coöperate in this way.

There are no rural mail carriers within the protective area, but in other parts of the state the carriers should be a great assistance in promptly noting and reporting fires.

The railroads of Wisconsin, particularly within the protective area, have shown a keen interest in coöperating in fire prevention, and after several years' efforts, and the expenditure of thousands of dollars, they have developed spark arresters, which although not perfect are a long step in advance and have reduced the number of forest fires set by railroad locomotives to a very marked degree. The law now provides that all locomotives on main lines must be equipped with the most efficient spark arresters, and that locomotives on branch lines or spurs in the forest region must have screens over the smoke stacks, so as absolutely to prevent the escape of all sparks. This last provision of the law has worked particularly well, and during 1911 and 1912 the railroads did not cause a single bad forest fire in the protective area. The railroads have also appointed inspectors at each division point and roundhouse, whose duty it is to examine each locomotive each day during the fire season, in order to see that all spark arresters and screens are in good condition.

Men in each section crew have been designated to act as fire patrols along the railroad lines in case of dangerously dry

weather, but during both 1911 and 1912, it was not deemed necessary to call on the railroads for such service.

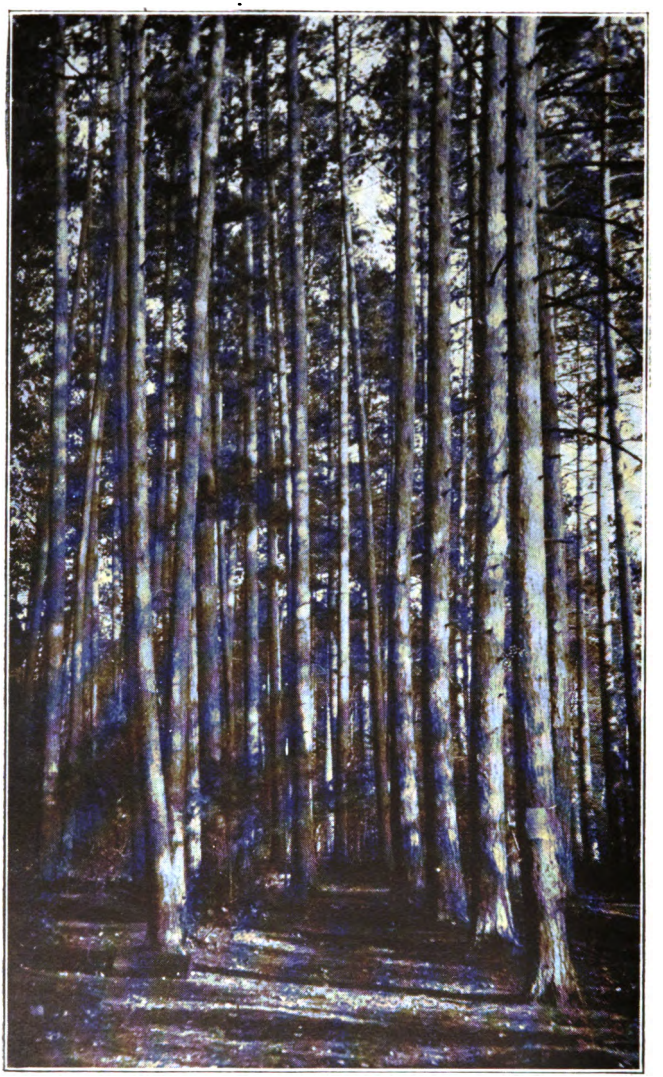
The Federal fire coöperation has been extremely valuable to Wisconsin, especially for the following reason: The protective area at the headwaters of the Wisconsin and Chippewa rivers comprises some 1,260,000 acres, and as the state only has 12 forest rangers it would have been impossible for them to adequately patrol this large area, and their work would have been confined to approximately 260,000 acres of state lands, leaving 1,000,000 acres of privately owned lands unprotected. With the assistance of the 12 Federal patrolmen, it has been found possible to divide the entire area of 1,260,000 acres into districts, so that all portions, including both state and privately owned lands, have received equal protection.

The 1,000,000 acres of privately owned lands, many of which are heavily timbered, are worth on a conservative basis at least $5.00 per acre, and therefore it can be stated that the Federal coöperation has enabled Wisconsin to protect 1,000,000 acres of timberland upon the headwaters of the Wisconsin and Chippewa rivers, both of which are important tributaries of the Mississippi river, and worth at least $5,000,000, which would have been impossible without this coöperation.

As the Federal patrolmen received $4,431.25 in 1911, and $4,238.50 in 1912, the cost of protecting the 1,000,000 acres of privately owned lands has been less than 1½ cent per acre per annum.

In 1913 the same protective area of 1,260,000 acres must be patrolled, and it is hoped that we may have another season of well distributed rainfall, so that the fire protective system of roads, fire lines, telephone lines and lookout towers may be extended. It is extremely important that the fire protection system should be completed as rapidly as possible, and therefore it is hoped that the Forest Service will be able to increase the allotment of Wisconsin for 1913 to at least $8,000, as this would permit the employment of 15 Federal patrolmen for 7 months, or from about April 15th to November 15th. The state would then increase its forest ranger force to at least 15, and would continue as in the past, to give most of the rangers and patrolmen crews of from four to seven men apiece, so that the building of the protective system of roads, fire lines, etc., should be pushed as rapidly as the state forestry funds will allow.

During 1913 Wisconsin will have available for all of its for-



MATURE PINE ON TROUT LAKE.

This timber is now worth over $450 per acre.

estry work, outside of the funds appropriated for the purchase of lands, about $75,000, and of this amount it is expected that at least $25,000 will be available for the fire protective work.

Summary of Summer Resort Business.

The forest reserve region should become in time a great summer resort for people throughout the entire Mississippi valley, as it has a fine, bracing, dry climate, pine forests and sandy soil, and is blessed with many of the finest chains of lakes in the entire country. Vilas county in particular has a greater area of water than land, and long trips can be made by launch or canoe. There is plenty of sport both for hunters and fishermen, and the resorts furnish good beds and excellent board at reasonable prices.

The summer resort business in northern New York state, which is largely within their forest reserves, amounts to approximately $10,000,000 a year, this amount being paid by the tourists, as they are called, in railroad fares, to hotels, boarding houses, etc. New Hampshire does about as well and the summer business gives the old state of Maine nearly $20,000,000 a year.

The summer resort business within the forest reserve area of Wisconsin is in its infancy but should grow very rapidly now that the state is building up a permanent forest reserve, which will be protected from the forest fires that were rapidly ruining that beautiful region.

In order to get at least an approximate idea of the summer resort business within the forest reserve area one of the cruisers employed by the State Board of Forestry in connection with his other work has either personally visited or corresponded with every resort owner in this region. Blanks were prepared which have been filled out by 91 of the resorts, and this opportunity is taken to thank the resort owners for their hearty coöperation in making the investigation a success. As the blanks have just been received it is only possible to include in this report a brief summary of the investigation. Later on it is hoped to publish a report that will include the name and location of each resort, number of guests that can be accommodated, and other information that will be useful to summer tourists visiting the forest reserve.

The following table shows the average annual summer resort business within the forest reserve region:

Number of resorts	91
Number of buildings	639
Number of guests that can be accommodated at one time	4,372
Number of guests accommodated in year	13,131
Gross receipts in year	$356,025

Following are the rates that are charged:

Board and room.	
Per day, $1.25 to $3.00, average	$2.00
Per week, $8.50 to $14.00, average	12.00
Guides	
Per day, $2.50 to $3.00, Average	$2.50
Boats.	
Per day, 50c to 75c, Average	$.50
Per week. $2.50 to $3.50. Average	3.00

The hotels in the small towns within the forest reserve area, which get a large share of their business from the summer tourists, together with the livery stables and boat liveries, report a gross annual business of $59,075. It is probably safe to estimate that 50% of this amount or $29,537, is paid by summer tourists.

It is also estimated that on an average each guest at a resort spends $12.00 for railroad tickets and berths, and $10.00 for hunting and fishing licenses, hire of guides and incidentals. Based on these estimates the annual summer tourist business within the forest reserve area amounts to about the following:

Railroad and Pullman fares	$157,572
Board and room at resorts	356,025
Hotels, liveries, and boat liveries	29,537
Hunting and fishing licenses, guides, etc	131,310
Total amount of business	$674,444

It should be clearly understood that the figures in the above table, except the $356,025 for board and room, are simply estimates, but it is believed that they are fairly close to the truth, and certainly the annual business must amount to somewhere between $600,000 and $700,000.

There are hundreds of lakes within the forest reserve area, and when these are protected, together with the forests, and as the hunting and fishing constantly improves, the resort business should increase to a very large figure.

State Aid for Schools and Local Government.

The state has been purchasing large tracts of land in northern Oneida and Vilas counties for the state forest reserves, and in order to consolidate and block up the reserves the state

should own about the following acreage of land in the counties which are within the boundaries of the reserve:

Vilas	506,000 acres
Oneida	345,000 acres
Forest	253,000 acres
Iron	115,000 acres
Price	70,000 acres
Total	1,289,000 acres

A few small communities within the forest reserves, notably Woodruff, Sayner, Star Lake, Manitowish and Mercer, are going to find it very difficult to raise sufficient funds to provide good schools and to pay the expenses of local government on account of the state's owning so much land upon which no taxes can be paid. During 1911 and 1912 the State Board of Forestry has built 159½ miles of roads within the forest reserve area at a cost of approximately $18,821. This region was very badly in need of roads and those that have been constructed by the state have not only opened up the country for the few settlers, but have been of great assistance to the resort owners and the thousands of summer visitors. In building these roads the state has relieved the towns of a very heavy expense, and it is felt that this work of development, which was so badly needed, is fully appreciated by the settlers and other resident owners, but as they very justly say, there still remains the cost of schools and local government, in which the State Board of Forestry has had no authority to assist.

There are only a few children of school age in any of the small towns within the forest reserve, and therefore the fair share which the state should pay towards the schools, and the cost of local government should not be large. Upon just what basis the state's share should be fixed seems to be rather difficult to determine, for while in some large towns there are few children and low costs of government, in other small towns there are a good many more children and as heavy, if not heavier, costs of government. It would seem as if a just way to determine the state's share would be to take the total cost of schools and local government in any town, and the state's proportion would be determined by the percentage of land which it owned in that town. However, such a rule as this would not be just to the state in every case, and the correct solution of this problem will demand the best efforts of the legislature.

EDUCATIONAL.

Forest Ranger School.

The Regents of the University have established a department of Forestry in the College of Agriculture for the purpose of organizing courses of study for the training of Forest Rangers, and also to give instruction to both long and short course students in agriculture, in the care of woodlands, especially the management of farm woodlots.

The practice of forestry by the owners of timber land, the organization and rapid development of definite forest policies by the states, and the organization of forest fire protective associations, are bringing about a demand for young men who have had practical training in Forestry. It will be the aim of the Ranger School to meet this demand by preparing men for such secondary positions as rangers, guards, tree planting experts, nursery foremen, and other positions with lumber companies, commercial nurserymen, and the owners of timber estates. Young men who have already gained some experience in woodcraft and in practical lumbering operations will find this course of especial value, as they will receive training which will fit them for the more expert quality of service which is demanded by modern methods of handling timber holdings.

This two year course is not offered as a complete education in Forestry. On satisfactorily completing the course, the student will be a trained ranger or guard, or an expert in tree planting and forest nursery practice, but he will not be a professional forest engineer.

The life of a ranger is a life in the woods, and no one should enter the school with any misunderstanding in this respect. Students who are not physically able to do hard woods work and who do not care for the rough outdoor life, are advised not to enter the course.

Facilities for the Course.

The Ranger Course will be offered in coöperation with the State Board of Forestry, field instruction being given on the state forest reserves. It is not expected, however, that the men trained in this work will be used exclusively in the State Forest Service.

By this coöperation with the State Board of Forestry, special facilities are offered for the student to gain practical training in forestry. A term of instruction will also be given each year at the College of Agriculture, thus providing facilities for instruction not only in Forestry, but also in the other closely allied subjects.

The state forest reserves now comprise about 400,000 acres, principally located at the headwaters of the Menominee, Wisconsin, and Chippewa rivers, in the counties of Forest, Oneida, Vilas, Iron, and Price. The reserves are divided into districts with a forest ranger or patrolman in direct charge of the field work in each district.

A large forestry headquarters building with boathouse, barn, storehouse, wood and ice house, etc., has been erected at Trout lake, in Vilas county. Here is located the main forest nursery which contains some 2,500,000 young trees that will be planted on lands denuded through lumbering, followed by forest fires. Another forest nursery will be started at the Carr lake ranger station in the spring of 1913, and it is planned to have eventually at least, a small forest nursery at each ranger station.

Comfortable houses for the rangers, with barns, wood and ice houses, etc., have already been built at the following ranger stations: Little Carr lake, Plum lake, Oxley and Rest lake; and during the winter of 1912–13, houses will be built at Star lake and Carroll lake. All ranger stations are connected by telephone with the nearest towns and with the forestry headquarters building.

General Plan of Course.

The Forest Rangers' Course includes work during two years, arranged each year according to the following plan:

(1) Work at the University from January 7, 1913, to April 15.

(2) Work on the state forests under the direction of the Professor of Forestry and in coöperation with the State Board of Forestry, from April 16 to July 31.

During the field instruction period, the student will receive board and lodging, but will be expected to devote practically one-half of such period to practical work in connection with the instruction work.

(3) From August 1 to November 30 the student may continue his work on the forest wholly under the direction of the State Board of Forestry. For this period he will receive, in addition to maintenance, $40.00 per month.

During the season of 1913, from August 1 to November 30, the State Board of Forestry cannot take over ten or twelve students; and this number will be selected at the end of the field instruction period, depending upon progress made and standing during the course.

Location of Field Work.

The field instruction will be conducted for the most part at the field Headquarters Camp of the State Board of Forestry, which will be placed at the disposal of the school. This camp is in the center of the state forest reserve region, and is located on Trout lake, which is some twelve miles north of Woodruff, Wisconsin, a station on the Chicago and North Western Railroad. The region offers an exceptional opportunity for the student to study all phases of forestry, especially from the standpoint of fire protection, which is the greatest problem confronting lumbermen and foresters. Side trips will be taken to all points of the reserve and much of the time will be spent in tents during the summer months.

After the close of the field instruction period selected students will be assigned work under the direction of the State Forest Rangers during August, September, October, and November. Exceptional opportunities will be given the student to gain practical field experience in the various lines of forestry management, such as making roads, trails and fire lines, building bridges, telephone lines, and lookout towers; establishing section lines and corners, fighting fires and patrolling, burning slash, and studying the tree growth and logging methods.

The nursery work will be carried on at Trout lake and Toma-

hawk lake throughout the season, and practical work in cone collecting, seeding, care and protection of seedlings, planting, transplanting, and field planting will be an important feature of the work of the student.

Tuition and Fees.

Tuition for residents of Wisconsin	Free
Tuition for nonresidents	
First term (at University)	$7.50
Second term (in field)	7.50
Incidental fee (for all students)	
First term (at University) (including medical and gymnasium fees)	4.00
Second term (in field)	2.50
Laboratory fees (for all students)	
First term (at University)	5.00
Second term (in field)	7.50
Key and breakage deposit (balance refundable)	2.00
Other expenses	
Books, approximately	15.00
Board and room (at Madison) approximately, per month	25.00
Board and room (in field) furnished free at headquarters camp by State Board of Forestry as compensation for practical work done.	

A list of rooms and boarding places, to aid students in securing desirable accommodations at the University, will be furnished upon application. All students live in private homes, as the University has no dormitories.

Mail should be addressed to the College of Agriculture, Madison, Wisconsin, and marked "Ranger Course."

Courses of Study.

First Year.

Dendrology and Silviculture	Woodcraft.
Soils	Meteorology.
Land Surveying and Mapping	Fish and Game.
Introduction to Forestry	First Aid to Injured.
Physics	Mechanical Drawing.

Second Year.

Forest Measurements (Cruising)	Silviculture.
Utilization (Lumbering)	Forest protection.
Tree diseases	Forest Law.
Forest Entomology	Forest Administration Policy.

Every student will be given a thorough physical examination by the medical examiner, and will be required during the Uni-

versity term to take two half-hour periods per week of development exercises and athletic drill. These activities are carried on in the stock pavilion which has been equipped with facilities for this purpose, including gymnastic and athletic apparatus, lockers, and shower baths. Lectures on hygiene and the laws of efficient living will be given by members of the department of Physical Education.

The Ranger Course will be in charge of Assistant Professor F. B. Moody, formerly Assistant State Forester of Wisconsin. The courses in Soils, Land Surveying and Mapping, Mechanical Drawing, Entomology, Tree Diseases, and Physics will be given in various departments of the College of Agriculture, and all other courses in the department of Forestry.

Description of Courses.

First Year.

Dendrology (In department of Forestry). Characteristics of the important timber trees of the lake states. Forest regions of the U. S., their commercial importance and distribution in Wisconsin. Detailed study of the species of trees native to Wisconsin. Field practice.

Silviculture (In department of Forestry). Relation of forests to factors of soil and climate. Factors influencing growth and distribution of trees. Seed production, time of seeding, cost of gathering seed, raising of seedlings, transplanting, field planting. Methods of handling species especially adapted for Wisconsin conditions. Field practice.

Soils (In department of Soils). Origin, classification, physical and chemical composition. Relation between forest growth and soil condition. Effects of tillage and fertilizers. Differentiation of agricultural and forest lands. Field practice.

Land Surveying and Mapping (In department of Agricultural Engineering). Land survey; Scheme of U. S. public land and other surveys in the U. S. Problems involved in relocation of old land surveys. Methods of relocating adapted to forest work. Demarcation of forest boundaries. Use of surveying instruments, such as hand level, compass, transit, aneroid barometer; theory and practice of compass, and chain surveying.

Field work will include running lines, pacing, locating and establishing section corners, topographic mapping.

Mathematics (In department of Forestry). Mathematical operations of simple surveying.

Introduction to Forestry (In department of Forestry). Brief history of forestry and its development in Wisconsin.

Second Year.

Forest Measurements, Cruising (In department of Forestry). Use of various log rules. Method of measuring logs, lumber, bark, piling, etc. Determination of rate of growth in height and diameter of trees and volume of single trees and stands. Field practice.

Utilization (In department of Forestry). Logging and milling (cutting and skidding). Methods of manufacture of pulp, lumber, veneer, charcoal, woodenware, etc. Uses of the various wood produced within the state and points of production. Wood preservation. Logging tools and implements (costs).

Tree Diseases (In department of Plant Pathology). Local diseases of the more important timber trees. Life history and methods of control.

Forest Entomology (In department of Economic Entomology). Description and life history of insects injurious to forest trees of the lake states region. Methods of control.

Forest protection (In department of Forestry). From fires, wind, insects, etc. General scheme for state forest reserve. Fire lines, purpose of; how constructed, where located, costs. Source of danger from fire, campers, fishermen, hunters, settlers, locomotives, lightning.

Telephone lines. Construction. System used—ground line, pole line, tree line. Equipment used per mile and per station, costs. Maintenance. Fire tools, cost.

Roads. Laying out, grading, building, purpose of, cost per mile. General plan of roads for reserve.

Lookout towers. Location. Construction, steel and wood; specifications of; cost. Methods of locating fires, use of maps, etc. Reports.

Ranger cabins and barns. Requirements for ranger. Methods of construction and costs.

Physics (In department of Forestry). Lectures on the elementary principles of solids, related to the subject of forestry. Pulleys, lever, resultant of forces, friction, jack screws, humidity. (For students who have not had high school physics.)

Meteorology (Special lectures). Weather forecasting and observation. Storms, winds, humidity.

Fish and Game (In department of economic Entomology). Care and propagation. Habits, usefulness and protection.

Forest Law (Special lectures). Leases, titles, conveyances, abstracts. Federal laws and laws of states regarding fires, trespass and taxation.

Forest Administration and Policy (In department of Forestry). Organization of state service. Qualifications. General plan of development of the Forestry Board.

First Aid to the Injured (Special lectures).

Woodcraft (In department of Forestry). Camp practice and cookery, packing, care of horses. Supplies for field trips and costs of supplies and camp outfits. (Given in the field.)

Lectures on Forestry.

During 1911 and 1912 a number of lectures on forestry were given throughout the state to various clubs and associations, and in nearly every case lantern slides were used to illustrate the difference between ordinary lumbering operations and forestry methods. The public as a whole know very much more about the general principles of forestry than they did a few years ago, as so much has been written about the conservation of natural resources, but there is still a rather general impression among many people that forestry is horticulture or landscape gardening. Of course this is an absolutely wrong impression, as forestry is the management of timberlands so as to insure successive crops of timber, and a continual campaign of education is necessary in order that the people of the state may appreciate the great economical questions that are involved in the conservation and systematic management of the forest resources of Wisconsin.

The staff of the Forest Products laboratory, which is located at Madison, during the winters of 1910–1911 and 1911–1912, gave some sixty lectures on the general principles of forestry, the course being open to all students of the University, and they

also gave a technical course, of about the same number of lectures, on the utilization of forest products and wood preservation, to the junior and senior students, in the College of Engineering.

Study of Farm Woodlots.

During the summer of 1912 Professor O. L. Sponsler, of the Department of Forestry, University of Michigan, made a preliminary study of the condition and present management of farm woodlots in three typical counties of Wisconsin, namely, Sauk, Lincoln and Manitowoc. A large amount of data was secured which shows quite clearly what must be done to improve the condition of the farm woodlots in each of these counties. It is intended to publish this information in the form of bulletins, one for each county, and to send them to the farmers. Following is Professor Sponsler's general report with his conclusions and recommendations:

Typical Woodlots of Wisconsin.

During the summer of 1912 a study was made of the farmers' woodlots and of the economic or other factors relating to their development or lack of development. The work was done under the supervision of the State Forester.

Three counties were covered,—Sauk, Lincoln and Manitowoc, chosen because they represent more or less typical regions of the state. Sauk county is representative of a considerable area of hilly country, part of which is more suitable for growing timber than agricultural crops; Lincoln county, of a region on the frontier of farming, where timber interests and farm interests meet; Manitowoc county is representative of a hardwood pine country after it has been under cultivation for a generation or more.

The work was of a general nature leading to a more detailed study of the individual woodlot and of the influences acting upon its development. Data was collected in each county to show the present condition of the wooded areas, and their treatment; the attitude of the farmer toward his woodlot; locations were noted for later detailed work, which will determine the value of the different methods of treatment of woodlots and the kind of woodlot best suited to the locality.

This report is in the nature of a summary of the data collected and the conclusions drawn from them. It should be understood that before recommendations other than of a most general and approximate nature can be made, sufficient data from specific detailed field studies must be collected.

Improvement of the woodlots throughout the state might then be obtained by a persistent diffusion of the recommendations and conclusions. Model or demonstration woodlots would be of great value to show the woodlot owner in his own locality what could be done with a little proper care.

Sauk County.

Sauk county, situated in the south central part of the state, contains about 24 full townships. The Wisconsin river forms its southern boundary. The rainfall averages 30 inches, of which half comes during the 21 weeks of growing season between May 10 and October 1. Corn yields well and quite a little tobacco is grown in this county.

About half of the county is rather steep slope land, one-fourth quite level table lands, and the remaining fourth is level river bottoms and prairie. The table lands are from 200 to 400 feet above the valleys and prairies.

Practically all of the land that is fit for the plow is now under cultivation. The land can be roughly classified as follows:

Total area of county	532,000 acres	100%
Cities and villages	6,000 acres	1%
Cultivated	180,000 acres	35%
Woodland	88,000 acres	17%
Brush and pasture lands	220,000 acres	40%
Swamp, sand barrens, rock	38,000 acres	7%

In the western part of the county the farms average about 120 acres, the table-lands and valleys are cultivated and the slopes left are covered or partially covered with woods. This part is essentially a dairy country and all land available is used for pasture.

In the eastern part the farms are generally smaller. The method of farming is rapidly changing over to dairy farming although very large areas here are without water.

This brings up the problem of the value of combined woodlot and pasture. It is generally held among foresters and by a large percentage of the farmers that the greatest income from the land is not derived when woodlots are pastured. This should be determined by experimental areas.

The woods are mainly hardwoods with a little jack pine on the north side and south side of the county. The amount of woods distributed over the county varies with the distance from the railroads. The amount of land cleared seems to be governed by the distance from a shipping point for wood products. In this county the townships within a five mile haul of railroads contain less than 15 per cent of wooded land, while those farther away run from 20 to 30 per cent wooded. From the agriculturists' viewpoint, the country as a whole has almost the ideal proportion of woodland, i. e., nearly 20 per cent.

By far the greater area of timberland is under oak. The ridges and hills, generally nonagricultural lands, are covered with young stands of oak, 30 to 50 years old, much of it will yield 25 to 30 cords per acre or more. The ridges in the vicinity of Baraboo are covered for many square miles with this kind of growth in almost unbroken stands. The land is divided into small plots of 10 to 90 acres and owned by farmers who live often several miles away.

This type of woods has reached a stage at 30 to 50 years old, where the advice of the well trained forester is needed in its treatment. At present it is in excellent condition, but unless proper care is taken the stand will rapidly deteriorate, and the result will be a large area of "oak openings" such as are now common in the older settlements of Ohio and southern Michigan, non-productive and undesirable.

The four or five townships on the north side of the Baraboo river are rather sandy and have scattered woodlots of scrubby oaks and in places considerable jack pine. About one-tenth of this poor area is covered with woods.

There is another long, narrow, sandy area of less extent in the southern part of the county along the bluffs of the Wisconsin river. A great deal of this sandy country is not fit for agriculture, although attempts are made and failures noted. It does, however, grow pine at a fair rate. At present the woods are in an open and altogether unprofitable condition and no attempt is made to improve them.

In a few valleys and on richer slopes there are still left small areas of maple-basswood or elm-ash woods, which have not been cleared for the plow. Some of them are in excellent condition, but most of them are culled or too open. In some places white pine has formed an important part of the woods.

Although several thousand cords of fuel wood are shipped out of the county each winter, the cities and villages report a scarcity of firewood. A few portable saw mills and several stationary mills take care of the local work. Generally throughout the county the wood is used up to the best advantage. Very little dead stuff is left in the woods and cordwood is cut down to two inch sticks. Often the tree is cut to produce the best in logs, then ties, then fuel wood. The latter, however, is the chief product.

There will be very little land cleared in the future. The farmers want to keep the woodlots they now own to raise wood; and many realize that they must have young trees, middle-aged and old ones, if they expect to cut year after year. Many realize, too, that in order to have small trees start, they must keep the cattle out of the woodlot. Only a few stop to consider the effect of grass in the woodlot, or the benefit of a dense fringe of limby trees or brush on the border of the woods. A number of farmers cut only the large trees and allow the small ones to grow. A few cut clean and allow the sprouts to form the next generation of woods.

The woodlots in Sauk county are not in a deplorable condition, by any means. It is true however that most of them could easily be made to yield more than they do at present. Very few farmers have any definite idea of the amount of wood they take from the woodlot year after year, and still less of the amount of wood their woodlot is growing every year.

Work on typical areas of woods on the Baraboo ridge in the eastern part of the county, in the sandy regions, and on the slopes of the western ridges, should be carried on to show in dollars and cents how much the woodlots are now earning and how much they could earn under proper treatment.

Further, a careful study of the coppicing power of the oak in various parts of the county should be made. This is extremely important to the future of the oak woods now existing. When this information is once gathered it should be persistently distributed to woodlot owners. A few demonstration areas, state owned, on which typical methods of care of the woodlot are shown, would pay the state well. A rather radical suggestion for this county, but not at all impractical, is that the county own a good share of the sandy lands especially, and perhaps some of the oak ridges, and take care of them on good forestry princi-

ples, either through a county forester or through the State Board of Forestry.

The care of woodlots in Sauk county could not be improved to any appreciable extent by legislation, that is, through partial or complete exemption of taxes. A man on the ground with figures showing what woodlots are earning and what they can earn will accomplish much and cost little.

Lincoln County.

Lincoln county, situated in the north central part of the state, contains 30 full townships. The rainfall averages 32½ inches, annually, of which 15½ inches fall during the 15 weeks growing season between June 1 and September 20.

The surface of the county is rolling with generally low hills. The northern half of the county is fully 20 per cent swamp, the southern half a trifle more than 5 per cent; some of these may be drained. A rough classification of the land follows:

Area of county	564,000 acres	100%
Swamp, rough, rocky	113,000 acres	20%
Cultivated	20,000 acres	4%
Timber and brush land	423,000 acres	76%

About 80 per cent of the county is agricultural land and only 20 per cent is owned as farms, and only four per cent is broken by the plow. Lumber companies, land companies, speculators and large interests hold over 425,000 acres, while farmers hold 125,000 acres as farms. The farms are naturally more or less segregated.

From the viewpoint of development there are three classes of land, distributed in fairly well defined regions.

1. Unimproved, mostly timberland, some brush land.
2. Partially improved, now undergoing development.
3. Old, well developed farms.

The partially improved farms are scattered throughout the region, and occupy only about one-third of it.

The farms are generally large, 120 to 160 acres, although there are some less than 80 acres. Dairy farming seems to be the future method.

The forests in the county are four-fifths hardwood, or hardwood and hemlock, the remaining one-fifth is a strip on the north side of the county of jack pine and Norway pine stands. The swamps of spruce and tamarack would reduce both the hardwood and pine areas by about proportional amounts.

Very little of the sandy pine lands are improved, although a considerable amount is cut-over.

The hardwood and hemlock lands in the western half of the county are covered with a stand of timber that will take the lumbermen owners about twenty years to cut; in the eastern half the lands are mostly cut-over and settled, with scattered farms. A few townships in the south and southeast have been quite densely settled for a generation, and here although there are not as many woodlots as is desirable, they are generally in good condition.

In the area partially developed the land is in several stages of improvement from forest and brush land to stump pasture and tilled land. The forest is a necessity here to provide an income while part of the land is being cleared. A great deal of the woods left for the farmer has been exploited, leaving culled or young stands.

The woodlots in the southern area of improved lands are generally older with good stands of hard maple, yellow birch, basswood and hemlock. There are large areas of aspen scattered through the farm areas, and in many places the aspen is the only wood growing on the farm.

The woodlots in the hardwood area are found to be in the following conditions:

1. Burned-over lands now grow up to aspen of various ages.
2. Cut-over clean and now grown up to young yellow birch, basswood, hard maple, and some hemlock, often spots of aspen.
3. Cut-over for logs only, leaving culls which will make bolt wood and fuel.
4. Cut-over for white pine only, leaving a hardwood-hemlock stand of log timber and small stuff.

Ash, elm and soft maple enter into the composition, especially of the third class mentioned, that in which only logs have been removed.

Little thought is given to the woodlots, except as to how they can be exploited. Very few are suffering from grazing, because there is a large area of woods and few cattle. On the new farms the tendency is to clear the land as rapidly as it can be afforded, and generally the land that is not cleared is covered with brush and young stuff that would not pay immediately for its own clearing.

The wood that is cut is used up fairly well, for there is a market for everything, even to shaky, punky stuff, which can be sold for lime-kiln fuel wood. A local market is created for bolt wood by the manufacture of boxes, handles, hubs, excelsior, woodenware, etc., while the tannery takes the hemlock bark.

There is too much wood all around the people here in Lincoln county, and too great a desire to get the land cleared, to get them to consider with much seriousness the necessity of looking forward to a future supply. On almost every farm there will be an area left for woodlot, much of it will be young, because that is the only timber it would not pay to cut now. There is little that can be done now in this type of partially developed country for the betterment of woodlot conditions, unless it is a material aid in fire protection and a persistent system of warnings against killing out the young growth by grazing. If this is carried out, the forest growth will take care of itself, for it has several species prominent throughout (hard maple, yellow birch, basswood and hemlock) that, by their development of crown, keep the woods in prime condition with almost no help from man.

Exemption from taxes of a limited area for each farm might be a stimulus to the preservation of woodlands. Definite knowledge should be obtained in this county concerning the growth of the four or five important species, so that when the demand comes for the application of this knowledge the state will be in a position to aid immediately.

Manitowoc County.

Manitowoc is situated on Lake Michigan, about midway between the north and the south ends of the state. It contains about 16 full townships, with over 30 miles of lake front, and extends inland on an average about 20 miles. The rainfall averages 30 inches, of which 15 inches comes during the 22 weeks of growing season between May 9 and October 10. Small grains, oats, barley and rye are the chief crops.

The surface of the county is level, or rolling with low hills, the slopes of which are rarely too steep for agriculture. The waste lands, mostly swamps, some rough, broad river valleys, and some sandy areas make up about 10 per cent of the county.

A rough classification follows:

Total area of county	370,000 acres	100%
Waste land, swamps, etc.	37,000 acres	10%
Cities and villages	5,000 acres	2%
Woodlots	43,000 acres	12%
Cultivated (1911 crop report)	162,000 acres	44%
Pasture land mostly, with little brush land	123,000 acres	32%

The farms average from 80 to 100 acres in size. Dairying is the main method of farming, and all are old farms.

The county was originally covered with a good forest of hardwoods, hemlock and white pine. In the development of the country, the composition of the remaining woods was changed by various conditions, so that now on the sandy lands of the northeast townships, white pine is very common in mixture, and there are a few woodlots of pure white pine. The north third of the county has a considerable amount of hemlock and white pine mixed with the hardwoods. In the remaining two-thirds the hardwoods make up the woodlots.

Taking the county as a whole not more than 12 per cent of the area is covered with woodlots, just a trifle more than one-half as much as there should be for the best agricultural conditions. The center tier of townships is almost bare of woodlots, scarcely five per cent is covered. The part of the county north of this strip is better supplied (about 16 per cent covered) than that south (about 10 per cent in woods).

The composition of the woodlots varies considerably, due to the culling out of the different species. There are, for example, small woodlots of pure white cedar, pure hemlock, pure black ash, pure tamarack and stands of almost any combination of these four species; then there are pure maple, pure beech, and pure white pine, and also mixtures of these three; very often hemlock is in mixture with the three last mentioned. There are also a few woodlots of oak, especially in the west and south part. Occasionally small areas of birch and aspen are kept for woodlots.

Most of the woodlots are made up of old culled stuff which has been pastured until entirely free of young growth. There are, however, a few that are in excellent condition in that they have a good distribution of good species of all ages and form dense woods.

Comparatively little thought is put on the woodlot. A few farmers keep the cattle out in order to allow young trees to grow. A few use a little selection in cutting in so far as choosing large trees instead of small. Occasional patches of cedar are trimmed up to post height in order to get cleaner post material.

Almost one-half of the farmers in the county use coal for heating purposes. Very few places in the county are more than five or six miles from the railroad. The cities and villages fur-

nish good local markets, with their various wood-using industries, for bolt wood, fuel wood and logs.

Before very much improvement will be made on the woodlots of this county, it will be necessary to obtain definite figures on what woodlots of certain types are now earning and on what they can be made to earn. It will be necessary to show how much in dollars and cents is lost by the present method of management, or rather mismanagement, and how this method can be changed to one that will turn the loss to a profit. At the present time the farmers in a large part of the county are at the mercy of the coal market and this condition is on the increase. The acreage of woodlands is insufficient, even if growing at their best, to supply the population outside of the cities and villages with fuel alone, to say nothing of the wood for other uses on the farm.

The matter of cedar for fence posts should be investigated for it seems to be a promising source of profit.

A total exemption of taxes on woodlots with limitation would probably help as a stimulus to bring about better management of existing woodlots, and help to increase the acreage of woodlands.

At least five or six of the common types of woods mentioned above, that is, pure maple, pure hemlock, pure pine, pure cedar, and representative mixtures, should be thoroughly studied for the amount of wood produced annually per acre in their present condition, and in typical excellent conditions.

Summary.

1. The woodlots are for the greater part in poor condition. They are growing half a cord of wood or less per acre each year, when they should grow about a whole cord or more.

2. Many counties represent a distinct region in which the kind of woods and the condition of woodlots differ greatly.

3. Each kind or condition of woodlot needs a different method of treatment in order to make it serve its best use.

4. There is a general lack of knowledge among the owners of woodlots concerning the amount of wood in cords, or other unit of measure, that will grow each year on an acre.

5. There is also a lack of knowledge concerning the simple means of keeping a woodlot in its best growing condition.

6. There is a marked neglect of keeping account of the amount of material taken from the woods.

7. Some method of exemption from taxes of woodlots may help to improve the conditions, but there does not seem to be demand for it among the owners of woodlots.

Recommendations.

I. (a) Collect data on the amount of wood grown annually per acre in woodlots representing the most common condition in each region. Express this amount both in cords and in dollars and cents.

(b) Collect similar data in woodlots that are now in the best growing condition.

(c) Determine the species which will produce the greatest profits in each region.

(d) Determine the best method of improving the poorer woodlots.

II. (a) Persistently distribute this information among woodlot owners in small but frequent doses.

(b) Start model or demonstration woodlots in every county if possible, at least in every region of different forest types, and show by actual management of the woodlot the practical value of the information that has been distributed.

(c) To owners who ask for it, give advice and instruction, preferably directly to the owner while on the woodlot.

Experimental State Woodlots.

The best utilization of the thousands of farm woodlots in Wisconsin is not only extremely important to the owners themselves, but to the whole state as well, for if these woodlots are well managed they are going to furnish a very considerable part of the future timber supply of the state. In many of the northern counties the state owns a few scattered forties, some of which are timbered, and it is proposed that from forty to eighty acres of such land should be used by the state as demonstration woodlots to be operated in coöperation with the state or County Agricultural Experiment stations. It is rather difficult to explain to any farmer, by means of a report or bulletin just how he should manage his woodlot, but it becomes a simple matter when you can take him upon timberland that is being properly man-

aged, and let him see good and bad methods, and in addition give him all the costs of operation, net profits, and so forth.

The State and County Agricultural Experiment stations should give a short field course on woodlot management, using the state demonstration areas for nearly all of their work.

The farmer's woodlot, especially in the northern part of the state, should not only supply him with all the saw logs, timbers, fence posts, cordwood, etc., that he will ordinarily use, but he should also have considerable material to sell and will find that his woodlot is his bank upon which he can draw in time of necessity.

STATISTICS.

FINANCIAL STATEMENT.

Table 1. *Receipts.*

	Fiscal Year. 1910-1911	Fiscal Year. 1911-1912
Fines and Penalties (For Trespass)	$19.02	$1,835.33
Departmental Sales:		
Sales of products:		
Timber	7,728 50	12,532 31
Burned timber		4,673 06
Hay	406 95	111 26
Fuel		163 50
Land:		
Sales	109.462 54	32,813 32
Contract payments		7,092 33
Right of way		19 37
Rents	95 00	166 00
Interest on bank deposits	1,390 33	1,308 29
Dues on land certificates		1,297 00
Miscellaneous:		
Refund on supplies		83 35
Refund on freight		.71
Credit for empty bags		95 30
Payment for lost badge		3 00
Telephone		10 10
Sale of supplies		33 02
Total	$119,102 34	$62.237 25

Note. Tables 1, 2 and 3 are for fiscal years, in accordance with the method adopted by the State Board of Public Affairs in preparing a State budget, whereas all following tables are for the calendar years for which this biennial report is made.

Table 2. *Expenditures* (Capital).

	Fiscal year 1910-1911	Fiscal year 1911-1912
Land and Land Improvements:		
Land	$81,485 81	$79,433 84
Land improvements		
Reforestation		
Roads, trails and fire lines		
Bridges		
Water supply system		
Structures and (Attached) Fixtures:	2,822 19	12,826 48
Headquarters' camp		
Men's house		
Rangers' cabins		
Cabins on purchased land		
Barns and sheds		
Barn		
Woodhouse		
Ice house		
Boathouse		
Lookout towers		201 60
Machinery and Equipment (Permanent):		
Telephone system		181 51
Constructed		
Acquired through gift		
Laboratory Apparatus:		
Furniture and furnishings		421 57
Office at Madison		
Headquarters camp		
Office		
Household		
Land, Tools, and Equipment:		
Headquarters camp	1,261 13	979 57
Barns and sheds		
Wagons, sleds, etc		
Harness		
Total	$93,569 23	$94,184 57

Table 3. *Expenditures.* (Operation).

	Fiscal Year 1910-1911	Fiscal Year 1911-1912
General Administration:		
Salaries of officers	$4,000 00	$6,416 43
Salaries and wages of office employes	2,140 00	2,631 51
Traveling expense	1,245 37	3,149 21
Stationery and office supplies	150 85	230 81
Postage	375 76	384 13
Telephone and telegraph	68 49	27 15
Express, freight and drayage	212 14	593 54
Printing (other than stationery)	540 52	817 91
Sundry supplies and expenditures	1,317 53	1,749 45
Field Work,		
Salaries and Wages:		
Salaries of rangers	1,340 70	10,947 05
Salaries of forest assistants		848 00
Salaries of cruisers	5,419 57	6,356 37
Wages of laborers	128 33	13,773 80
Salaries for miscellaneous services	2,823 75	291 73
Compassmen	546 54	
Traveling expenses:		
Expenses of rangers	48 93	981 07
Expenses of assistants		169 29
Supplies and Expenses:		
Subsistence		8,507 47
Feed		491 14
Trees and seeds	1,354 34	217 07
Advertising	57 85	44 05
Total	$21,770 67	$58,627 18

LANDS

Table 4. LANDS PURCHASED AND SOLD, 1911-12.

	Acreage Jan. 1, 1911.	Acreage sold.	Acreage acquired.	Acreage Jan. 1, 1913.
Ashland	$5,401.20	1,235.00	.....	4,166.20
Bayfield	3,161.21	1,601.47	.....	1,559.74
Burnett	19,073.96	12,776.13	.....	6,297.83
Douglas	9,475.66	1,368.78	80.00	8,186.88
Florence	3,559.16	.....	80.00	3,639.16
Forest	35,427.34	.....	1,919.29	37,346.63
Iron	29,910.06	479.61	924.00	30,354.45
Langlade	2,299.40	880.98	.....	1,418.42
Lincoln	2,477.86	920.66	.....	1,557.20
Marinette	4,494.21	.....	.....	4,494.21
Oneida	53,310.63	374.80	20,418.81	73,354.64
Polk	1,960.74	118.17	.....	1,842.57
Price	27,474.45	9,152.58	320.00	18,641.87
Rusk	2,894.47	440.00	.....	2,454.47
Sawyer	13,519.14	1,707.88	171.95	11,983.21
Vilas	59,956.05	.....	71,602.08	131,558.13
Washburn	8,988.30	5,139.48	.....	3,848.82
Total	283,383.84	36,195.54	95,516.13	342,704.43

Note.—The above table does not include the state lands within the Indian Reservations, which total 47,003 acres.

Table 5. AMOUNT RECEIVED OR DUE FROM LAND SALES, 1911-12.

	1911	1912
Ashland	$ 1,852.00	$ 2,146.00
Bayfield	2,113.00	1,842.00
Burnett	32,653.00	13,731.00
Douglas	2,965.00	2,330.00
Florence	.	.
Forest	.	.
Iron	1,197.00	1,762.00
Langlade	1,579.00	1,524.00
Lincoln	937.00	1,644.00
Marinette	.	.
Oneida	2,371.25	.
Polk	130.00	484.00
Price	10,115.00	13,869.00
Rusk	.	2,322.00
Sawyer	5,528.00	2,785.00
Vilas	.	.
Washburn	8,369.00	7,089.00
	$69,809.25	$51,528.00
Total		$121,337.25

Of the above amount of $121,337.25, only a portion has been actually received, as a law went into effect June 28, 1911, by which certain state lands could be sold on 20 years' time, and as a matter of fact only $71,564.54 has been paid into the Forest Reserve fund, and $17,138 of the balance will not become a part of the Forest Reserve fund, as it was received for school lands or other lands than forest reserve, that lie north of town 33.

The price received for all lands sold averages $3,357 per acre. (54.80 acres of the land disposed of was given in exchange for other lands.)

Only three descriptions of purchased land have ever been sold by the state. The cost of these descriptions in 1908, was $352.11; the price received in 1910 was $408.

Table 6. SUMMARY OF ACQUISITIONS OF LAND, 1911 AND 1912.

	Acres.
Land purchased in 1911	49,882.92
Land purchased in 1912	44,529.93
Land acquired by Federal grant (The acquisition of this land practically completes the grant of 20,000 acres to the state made by Act of Congress approved June 27, 1906)	852.78
Land acquired by Federal grant (All unsurveyed and unallotted islands in inland lakes north of town 33. Acreage not yet determined)	.....
Land acquired by exchange	130.50
Land transmitted from Land Office records	120.00
	95,516.13
Amount of land held under option	None
Amount of land held under contract	(See Tables 8 and 9)

Table 7.

NAMES OF PERSONS FROM WHOM LAND WAS PURCHASED IN 1911 AND 1912.

	No. of acres.	Price per acre.	Price
Matt Plunkett	80	$2.50	
Buswell Lumber & Manufacturing Company	600	2.50	
†Ross Lumber Company	10		$30.
Alexander Stewart Lumber Company	640	3.00	
Yawkey-Bissell Lumber Company	8,550.54	2.50	
Land, Log and Lumber Company	15,893.95	3.75	
Robert Stamp	400	2.50	
G. F. Sanborn	102.30	3.00	
B. F. Wilson	2,194.30	6.50	
Yawkey Lumber Company	2,317.76	3.75	
Turtle Lake Lumber Company	80	3.50	
Turtle Lake Lumber Company	284	3.00	
A. E. Doolittle	85.25	3.50	
C. H. & W. L. Houlton	440.72	4.00	
Blue Grass Land Company	3,678.00	2.50	
Blue Grass Land Company	35.75	3.00	
Blue Grass Land Company	402.92	3.50	
*N. A. Colman	Island		$1,000.

Table 8.

NAMES OF PERSONS FROM WHOM LANDS ARE BEING PURCHASED UNDER LAND CONTRACTS.

	No. of acres.	Price per acre.	Amount paid Principal.	Interest.	Amount Due.
G. F. Sanborn Company	27,655.32	$3.50	$70,076.11	$3,853.34	$20,000.00
Land, Log & Lumber Co.	19,679.52	4.60	10,000.00		80,525.79
H. W. Wright Lumber Co.	11,241.66	3.50	10,000.00		39,345.81

Table 9.

NAMES OF PERSONS FROM WHOM LANDS ARE BEING PURCHASED UNDER LAND CONTRACTS, NO PART OF THE PURCHASE PRICE HAVING BEEN PAID.

	No. of acres.	Price per acre.	Amount Due.
Yawkey-Bissell Lumber Company	139.02	$2.50	$347.55
Goodyear Lumber Company	230.10	2.60	598.20

† This government description is platted as 40 acres but there is actually only 10 acres of high land.

* This purchase was an island in Star lake and included all the timber on the island except the pine. The pine timber, also, was purchased from the A. H. Stange company and partly paid for by an exchange of timber on another description of state land.

Table 10.

NAMES OF PERSONS FROM WHOM LAND WAS RECEIVED IN EXCHANGE.

	No. of acres.
Turtle Lake Lumber Company	80.00
Ella L. Woodzicka	50.50

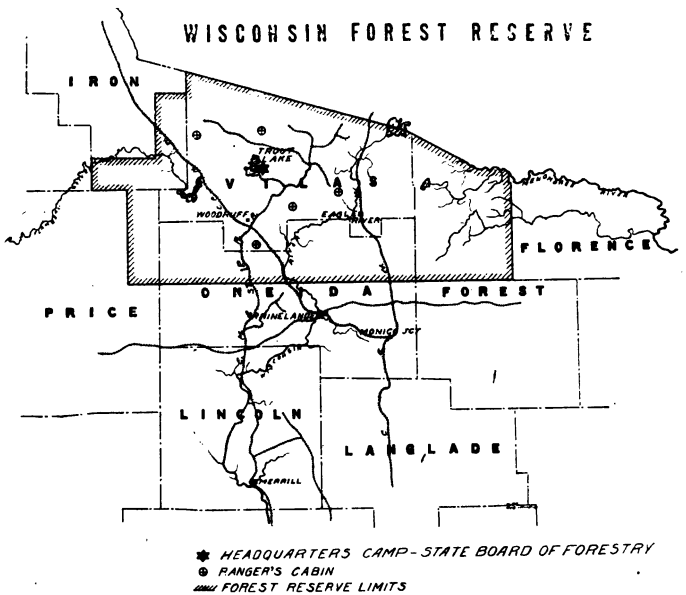
Commissions paid in connection with land purchases	None.
Total acres owned by the State, north of town 33	342,746.49 acres
Total amount invested therein	$421,857.79
Average amount invested per acre	1.637
Average cost per acre of lands purchased 1911-12	3.828
Average cost per acre of all lands purchased (exclusive of 3 purchases of heavy standing timber)	$3.32
Average cost per acre of all lands purchased (inclusive of 3 purchases of heavy standing timber)	3.45

The lands purchased within the last two years include a large acreage covered with good second growth timber, and include also hundreds of miles of lake shore frontage.

Table 11. LOCATION OF LANDS PURCHASED.

T. R.	Acres.
Iron county.	
42-4 E.	480.00
43-4 E.	444.00[1]
Forest county.	
36-12 E.	81.65
36-13 E.	480.00
37-13 E.	200.00
39-12 E.	40.00
39-13 E.	80.00
40-12 E.	1,517.64
Oneida county.	
36- 4 E.	40.00
36- 8 E.	80.00
36- 9 E.	40.00
37- 7 E.	40.00
37- 8 E.	75.61
37- 9 E.	320.00
38- 5 E.	80.00
38- 6 E.	935.36
38- 7 E.	2,582.66[2]
38- 8 E.	939.15
39- 4 E.	120.00
39- 6 E.	2,554.20
39- 7 E.	2,580.20
39- 8 E.	1,059.73
39- 9 E.	505.00
39-11 E.	1,348.30
Vilas county.	
39-10 E.	355.45
40- 4 E.	1,604.13
40- 6 E.	3,564.19
40- 7 E.	12,591.70
40- 8 E.	2,718.93
40- 9 E.	1,455.60
40-10 E.	167.70
40-11 E.	1,408.76
41- 6 E.	8,004.25
41- 7 E.	12,626.13
41- 8 E.	10,179.94
41- 9 E.	1,388.17
41-10 E.	240.00
41-11 E.	1,040.00
42- 5 E.	80.00
42- 6 E.	160.00
42- 7 E.	986.75
42- 8 E.	5,168.44
42- 9 E.	134.70
42-10 E.	760.00
42-11 E.	2,418.51
42-12 E.	160.00
43- 5 E.	640.00
43- 6 E.	635.00
43- 7 E.	3,096.19
43- 8 E.	168.45

[1] 80 acres acquired by exchange.
[2] 50.50 acres acquired by exchange.



MAP OF WISCONSIN FOREST RESERVE.